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Requirements for education meterial in color reproduction for photojournalists

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Master's Thesis

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Requirements for Educational Material in Color Reproduction for Photojournalists

By

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A thesis project submitted in partial fulfillment of the requirements for the degree of Master of Science in the School of Printing Management and Sciences in the College of Imaging Arts and Sciences of the Rochester Institute of Technology

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Thesis Advisor: Michael Riordan

Title of thesis: *Requirements for Educational Material in Color Reproduction for Photojournalists*

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Table of Contents

Abstract:

This thesis project examines a skills gap involving new technologies within photographic departments of many newspaper organizations. Traditional film based photography is now used in conjunction with digital photography. After images are acquired, photojournalists create electronic color separations within color imaging software. Quite often these separations are created without an understanding of the rules and concepts that govern quality color reproduction in newsprint. As advancements continue in digital imaging and prepress environments, skills must be acquired to ensure optimum color reproduction.

This thesis project examines the educational theories of Walter Dick, Lou Carey and Charles Layne as they relate to a systematic design of instruction. An analysis of these theories provides an appropriate learning module for obtaining the required skills in color separation techniques. These theories include the recognition and identification of the following: an instructional goal, an instructional analysis, identification of entry behaviors and subordinate skills, and the design of instructional content. Results of this examination have been used for the creation of an instructional guide for the photojournalist. This guide has been designed and written for the photojournalist working in the digital prepress environment who encompasses the identified entry behaviors and subordinate skills required for quality learning. The photojournalist may be a veteran within the industry or a student of the trade. An evaluation of this thesis project will be based on the following:

1. A proposed workflow based upon the identification of various color electronic separation techniques used by photojournalists. This workflow will be incorporated into educational material that facilitates an optimum learning of concepts and procedures inherent to quality color reproduction in newsprint.
2. The creation of printed educational material based upon the theories derived from instruction designers.

Chapter I

Introduction

In February of 1997, the International Newspaper Colour Association/Federation Internationale des Editueurs de Journax (IFRA) issued a special report entitled *Quality Failure Costs in Newspaper Production*. IFRA's special report establishes a framework for identifying the sources of quality failures. Within this report, a table of quality failures and causes was generated for the newsroom. One of these failures was picture quality, with technical problems and a lack of specific skills determined as a major source.

These failures are an indirect result of advancements in digital imaging technology relating to color reproduction on newsprint. These advancements have created a skills gap within newsroom photography departments. If this gap in skills is not addressed, failures in color image quality will continue to exist.

Skills that were once used in traditional darkrooms have been incorporated into color image processing software. This technology has placed a new demand on the photojournalist. Whether the photojournalist is a veteran of the trade, or a recent college graduate, digital workflow and procedures vary. Without an understanding of the rules and concepts that support quality reproduction, quality failures will exist. Performing prepress operations, software demands a new set of skills that require knowledge of photographic and reproduction techniques for print. Photojournalists' must obtain these specific skills to produce quality reproductions.

Prepress operations and image adjustments are preformed on several types of color originals. Traditional film and digital photography require digital workflow techniques for image preparation. Poor results in image quality are often the product of a lack of required skills for image preparation. The problem is compounded by the lack of educational material for the photojournalist regarding new skills for advancing technologies.

Much of the newspaper industry has not fully adapted to the requirements of the photography department. An analysis of their needs reveals a desire for updated skills in color image processing systems. Furthermore, the job responsibilities of the photojournalist does not always include time for training. The job description of the news photographer involves scheduling photo sessions, planning stories, and the capturing and processing of images. Many photojournalists lack the knowledge of graphic reproduction techniques, and therefore are hindered when applying the functions required for professional print production.

This thesis project will examine the skills gap related to new technologies within the photographic department. The result of this examination will be used as a basis for the development of a module for educational material based on a systematic design of instruction for the photojournalist.

Reasons for Interest:

As the researcher for this thesis project, my academic background lies in both photojournalism and graphic arts publishing. After completing my studies within the School of Photographic Arts and Sciences, I faced the impact of new technologies in industry. In addition, I recognized that my formal studies had failed to address the educational needs for a technically advanced work force.

After enrolling into graduate studies, I served as an intern within the newspaper industry. It was there that I witnessed first hand the challenges that faced photography departments. While new technologies enhanced productivity, quality standards floundered. As I researched this problem, I quickly located the cause. Photojournalists were grappling with new technologies, and converting over to digital photography without upgrading their formal skills. Researching the problem further, I found that very few photographers had an educational background in digital color reproduction. Furthermore, no formal education and very little training were offered for upgrading skills.

In observing the enrollment into the Graphic Arts Publishing program over the past few years, a trend may be found. Each year, enrollment finds more students coming from the School of Photographic Arts and Sciences. I, along with many other students have realized the effects technology has had on industry. Students have realized that a formal education in Electronic Publishing provides the necessary skills for success in industry.

As the researcher for this project, I am given the opportunity to address a need for updated skills required of the photojournalist. This researcher believes he holds the ability to make a significant contribution to industry. Through the development of educational material designed for the photojournalist, this project can ease the transition of the photographer into the digital prepress environment, and raise quality standards to an appropriate level.

Works Cited for Chapter I

Fuchs, Boris. *Quality Failure Costs in Newspaper Production*. Darmstadt, Germany: International Newspaper Colour Association, 1997: p.31.

Chapter II

Theoretical Basis of Study

The following information is a synopsis of the four components utilized in the construction of a systematic design of instruction. The proceeding theories are based upon the work of Dick, Carey, and Layne.

1. *Identification of an Instructional Goal:*

Dick and Carey (1990) write, "Instructional goals are clear statements of behaviors that learners are to demonstrate as a result of instruction." (*The Systematic Design of Instruction*, p. 24) The creation of an instructional goal is initiated by the recognition of unsatisfactory results based upon procedures utilized to reach a desired goal. In order to construct an instructional goal, one needs to ask a series of questions that will (1) locate and identify the problem, (2) pinpoint the failure, and (3) define the desired result. The need, once located, will represent a gap in skills preventing the desired outcome. Dick and Carey (1990) state, "This technique focuses on the 'what is' and 'what should be' in a particular situation. In other words a need is expressed as the gap between the way we would like things to be and the way they presently are." (*The Systematic Design of Instruction*, p. 13) The gap is usually a lack of information for the learner, faulty equipment, or individual skills. Identifying an instructional goal requires a complete assessment of the need(s) in order to refine and identify the need for instruction. Layne (1990) states, "The primary aim of needs assessment is to determine who needs training and what they need to know." (*Quality and Productivity in the Graphic Arts*, p. 23-2)

2. *Conducting an Instructional Analysis:*

Conducting an instructional analysis consists of three major identifications. The first consists of placing the instructional goal into one of four domains of learning. Based on the theories of Dick and Carey (1990), the four domains are identified as: "(1) psychomotor skill, involving mental and physical activity with or without equipment to achieve a specified goal, (2) intellectual skill, consisting of problem solving activity that requires unique cognitive activities in performing an activity, (3) verbal information, requiring the learner to provide specific responses to relatively specific stimuli, and (4) attitudes, the tendency to make particular choices or decisions while acting under specific situations." (*The Systematic Design of Instruction*, p. 32-34)

Once the domain of learning has been identified, the second step asks the instructional designer to construct an analysis of the pivotal steps required in completing the instructional goal. An analysis will lead to a flowchart of interrelated tasks that are performed in achieving a desired goal. Tasks within the chart are often based on prior tasks, and serve as the foundation for following tasks.

The final step in the instructional analysis is the identification of subskills required to perform the individual tasks. The skills often serve as the foundation in achieving the preferred goal. Dick and Carey (1990) state, "To ensure that an assessment of the required rules and concepts are known, a subordinate skill analysis is conducted. This step includes the identification of skills that, while perhaps not important in and of itself as a learning outcome, must be achieved in order to learn some higher or superordinate skill." (*The Systematic Design of Instruction*, p. 32) Layne (1990) further explains, "Often operational guidelines exist only in the minds of the experienced production staff. For a variety of reasons, standard operational procedures (SOP) should be written. First, you need to identify the tasks and the skills needed to complete each task." (*Quality and Productivity in the Graphic Arts*, p. 23-2) The basic question asked is: what would the learner have to know in order to learn how to perform the first step in achieving the goal?

3. *Identify Entry Behaviors and Subordinate skills:*

Carey and Dick (1990) define entry behaviors as, "Specific competencies or skills a learner must have mastered before entering a given instructional activity." (*The Systematic Design of Instruction*, p. 310) Once a target audience for learners has been established, one begins an analysis of entry behaviors inherent to the group. In seeking this common denominator within the audience, one can identify subordinate skills currently held among the audience. Dick and Carey (1990) state, "Subordinate skills that you judge all or most members of the target population already posses should be classified as entry behaviors." (*The Systematic Design of Instruction*, p. 96) In locating these skills, one can initiate instruction at an appropriate level within the group. In performing this analysis, one prevents the start of instruction with skills regarded as common knowledge among the group. In contrast, through the analysis of subskills, one is prohibited from beginning instruction at a level too advanced for the learner.

4. *Design of Program Content:*

The final component utilized from the systematic design of instruction will be the design of program content. The work of Charles Layne provides the foundation for this component. Layne (1990) states, "Once training needs are clearly identified, an array of programs may be needed to meet those needs . . . objectives pinpointed in the needs analysis should be organized into units of program content." (*The Systematic Design of Instruction*, p. 23-5) Layne refers to the organization of units into program content as a modular approach to education. Layne continues to outline a series of steps for consideration in the implementation of this design method. Layne (1990) states in step one, "Each unit should be one to five objectives representing skills or competencies determined in the needs analysis. The instructional activity associated with one objective in a unit is sometimes referred to as a module." (*Quality and Productivity in the Graphic Arts*, p. 23-5)

The second aspect is the process is the identification of concepts or rules that are inherent throughout the needs analysis. Layne (1990) states, "Common themes running throughout the program should be identified and introduced to participants early in training." (*Quality and Productivity in the Graphic Arts*, p. 23-5) Through an early identification of the common themes, learners may obtain the required concepts and rules that serve as a pivotal current throughout the procedural workflow.

The third aspect adopted for this thesis project is the separation of specific skills that may be required for quality instruction. Learners may be required to hold a basic foundation of skills generally taught in a separate curriculum. These skills although not important to the individual task at hand, may prove beneficial in the understanding of rules applied within the workflow. Layne (1990) explains, "It may be necessary to isolate and explain some skills in detail before trainees are shown how to perform them." (*Quality and Productivity in the Graphic Arts*, p. 23-5)

Through the identification of sub-skills, the learner may be able to better understand why they are performing a task, instead of simply following a structured list of instructions.

Works Cited for Chapter II

Carey, Lou and Walter Dick. *The Systematic Design of Instruction*. Glenview: Scott, Foresman and Company, 1990: p. 13,24, 32-34, 96, 310.

Layne, Charles. "In-Plant Training for Company-Wide Quality," in *Quality and Productivity in the Graphic Arts*. ed. Miles Southworth and Donna Southworth, 23-1 - 23-26. Livonia, NY, 1990: p. 23-2–23-5.

Chapter III

Literature Review

Currently, there are several books on the market dealing with color reproduction in the graphic arts industry. However, in reviewing the available literature there are very few books that deal directly with color reproduction in newsprint. Unfortunately, the number of books dealing with workflow procedures for the news photographer is even fewer. With the evolution of the photojournalist into the digital prepress environment, there is a significant need for instructional material. Richard Adams and Raymond Reinertson (1999) write, "Photographers now use digital darkrooms in which they take pictures with digital cameras, scan conventional slides themselves with desktop scanners, select digital wire photos, and retouch photos electronically. Technology, while it has simplified image capture, has brought a Pandora's box of creative and technical adjustments. 'Our photographers' job is to take photographs', commented one plant manager, 'they need to spend time in the field taking pictures, not scanning and adjusting them in the lab.'" (*Digital Color Reproduction in Newsprint*, p. 2)

New technologies within the photography department have created a need for advanced skills regarding graphic reproduction. As advancements have simplified the workflow process, inadequate skills have impeded progress in quality. To paraphrase Adams and Reinerston (1999) "While photographs today are still made in enlargers, image adjustments are more often done on a computer using a program like Adobe Photoshop, Live Picture, Linocolor, Color Blind Edit, and other suitable programs. . . . The time and expertise to make adjustments, however makes image preparation expensive and highlights the importance of starting with quality originals." (*Digital Color Reproduction in Newsprint*, p. 107)

As current job descriptions change within the digital environment, a need for upgraded skills has been established within the industry. Charles Layne (1990) writes, "Several common conditions underlie why training programs are needed. One of the most prevalent is related to quality. In industry's efforts to improve quality, many managers have learned that while most employees genuinely want to produce quality work, they often do not have the necessary skills to get the job done. . . . Finally, the increased use of computers and other new technologies requires that existing employee skills be upgraded." (*Quality and Productivity in the Graphic Arts*, p. 23-1)

As part of this thesis project, a systematic design of instruction will be implemented for the creation of educational material for the news photographer. Walter Dick and Lou Carey (1990) define the systematic design of instruction, " . . . it is a systematic process in which every component (teacher, students, materials, and learning environment) is crucial to successful learning. The parts of the system depend on each other for input and output, and the entire system uses feedback to determine if its desired goal has been reached." (*The Systematic Design of Instruction*, pp. 2-3) Dick and Carey outline three reasons to utilize a systems approach:

1. An initial focus that indicates what the learner is to do, or be able to do at the conclusion of instruction. Without this initial focus, subsequent planning and implementation steps can become unclear and ineffective.
2. The careful linkage between each component, especially the relationship between the instructional strategy and the desired learning outcomes.
3. It is an empirical and replicable process. Instruction is designed not to be delivered once, but for use on as many occasions as possible with as many learners as possible.

Consisting of a series of components that are linked towards a successful educational goal, and the ability to revise and reuse the system within an ever-changing technical environment, a systematic design of instruction is best suited for the photojournalist. This thesis project will combine the works of Charles Layne, Walter Dick, and Lou Carey in the creation of educational material for the news photographer. With the inclusion of educational theories derived from Layne, Dick, and Carey, a module for education will be structured through the following outline:

1. Identifying an Instructional Goal
2. Conduct an Instructional Analysis
3. Identify Entry Behaviors/Subordinate Skills
4. Design of Program Content

This thesis project will utilize the above outline for the construction of an educational module for the photojournalist. This module will assist the photography department in filling the skills gap required for quality color image reproduction through the appropriate workflow procedures.

Works Cited for Chapter III

Adams, Richard M. and Raymond N. Reinertson. *Digital Color Reproduction in Newsprint*. Sewickley, Pa: Graphic Arts Technical Foundation, 1999: p. 2, 107.

Carey, Lou and Walter Dick. *The Systematic Design of Instruction*. Glenview: Scott, Foresman and Company, 1990: p. 2-3.

Layne, Charles. "In-Plant Training for Company-Wide Quality," in *Quality and Productivity in the Graphic Arts.* ed. Miles Southworth and Donna Southworth, Livonia, NY, 1990: p. 23-1–23-26.

Chapter IV

Project Goals

There is currently a skills gap within the photography division of many newspaper editorial departments. This gap in skills is the outcome of technical advancements in the color prepress environment. If this gap in technical knowledge is not compensated for, quality failures in color image processing techniques will continue to exist in color image reproduction. The goals of this thesis project include:

1. Through the optimization of appropriate color imaging procedures and image processing techniques, photojournalists will construct digital image files that facilitate quality color reproduction in newsprint. This will be accomplished through:
   a.) The identification of common workflow procedures.
   b.) A suggested workflow based upon current procedures.
2. The organization of educational material based upon instructional message design to be used for the creation of a printed learning module. This will be accomplished by:
   a.) The research and development of educational material that facilitates quality learning for the photojournalist.
   b.) The construction of educational material based upon existing educational theories. These theories will be developed for updating the skills for the photojournalist within color image processing techniques.

Chapter V

Methodology

The 1999 edition of *Editor and Publisher International Yearbook* ranks the top one hundred American daily newspapers according to circulation. The population for this study includes those newspapers with a circulation in excess of three hundred thousand, a total of thirty daily newspapers within the United States. A list of these newspapers is located in Appendix A. These newspapers are considered the front-runners within the newspaper industry. Due to their size in the market, and competition, these thirty dailies have the greatest demands on new technologies and skills.

In conducting research regarding the needs and practices of the population, surveys will be created and sent to each of these publications via e-mail. Photography department editors, quality assurance managers, and graphic arts editors will be contacted and asked to respond to the survey. A copy of this survey is located in Appendix B. These individuals have been selected due to their daily involvement with new technologies and the resulting changes in workflow procedures.

Additionally, information regarding the construction of a systematic design of instruction (based on the work of Walter Dick, Lou Carey, and Charles Layne) will be analyzed. This information will provide a theoretical basis for developing a training module for the news photographer.

Work Cited for Chapter V

Editor & Publisher. *Editor & Publisher International Yearbook, The Encyclopedia of the Newspaper Industry Part 1: Dailies 2000.* NY, 1999: p. xi.

Chapter VI

Results

Identification of an Instructional Goal

Based upon the theories of Walter Dick and Lou Carey, the first step in creating an instructional goal is an assessment of the needs. Through an examination of quality failures in newsroom photography departments, digital workflow procedures are cited as a problem area. A need has arisen as photojournalists are required to create desktop color separations. Photojournalists must possess the knowledge of specific rules and concepts for the creation of quality separations.

Results from the questionnaire sent to U.S. daily newspapers have indicated a lack of knowledge in concepts inherent to the process. This survey is included in Appendix B. Question number eleven of the survey asked respondents to indicate from a supplied list, the concepts they believe either they, or their staff, may not fully understand. Forty percent of the respondents indicated color theory as a misunderstood concept. Thirty percent responded to a lack of understanding regarding the concept of image keyness. Additionally, twenty percent of respondents defined unsharp masking as a misunderstood concept. Quality exposures, neutrality and tonal adjustments were also indicated as concepts not grasped in the separation process. Based upon these figures, knowledge of color working spaces, tone reproduction, visual contrast, and detail enhancement are not fully understood in all newsroom photography departments.

Question number ten of the survey asked respondents to indicate their workflow procedure. A list of eight concepts was provided to signify workflow operations by identifying the order of concept application, with one being the first step. Every respondent indicated a different workflow. No two respondents indicated a similar workflow. While organizations may all work differently, the data collected from this question reveals an apparent variation among quality workflow operations.

Questions within the survey attempted to locate printing defects noticed by the photojournalist. The majority of responses indicated problems of color correction, detail, and contrast in reproductions. These defects reflect the concepts indicated as misunderstood in question number eleven. When asked to locate the problem, sixty percent of the respondents indicated the cause as stemming from pressroom operations. Additional responses indicate causes of prepress operations, image capture and communication between departments.

Respondents were asked if they believed educational material was needed specifically for the photojournalist. An overwhelming one hundred percent responded yes. One respondent added, "We have a staff of first rate photographers who have not been kept abreast of modern technical developments in scanning, capture and reproduction of their images using digital equipment. Some have a better technique then others in this area but all need instruction."

When asked what concepts they believed were most appropriate for education, fifty-three percent signified color correction. Other concepts considered most relevant for education were contrast and neutrality adjustments.

Finally, when asked what type of educational material was best suited for the photojournalist, a response of one hundred percent indicated a preference for hands on education. Thirty-three percent of respondents indicated the use of printed materials as their second preferred option in receiving educational material. Following options included: CD-ROM, lectures, consultants, workshops and other.

To further investigate the need for educational material in the newsroom photography department, Warren Watson, Director of Extended Learning for the American Press Institute was contacted. In an electronic correspondence, Mr. Watson indicated that educational material is needed for the photojournalist regarding the creation of quality color separations. When asked if training requirements were different for incoming, college educated employees as compared to veterans of the trade, Mr. Watson stated, ". . . younger people have more faculty with this kind of thing . . . however, both need training."

In locating the origins of quality failures, and identifying their causes, the problem is defined. Many photojournalists lack the required skills to consistently create quality color separations. In order to compensate for this problem, an upgrade in skills is necessary.

Identification of the need allows for the definition of a desired result. After analyzing the need, the instructional goal is stated as, photojournalists will construct digital files that facilitate quality color reproduction through an understanding and application of the appropriate rules and concepts inherent to creating professional color separations.

Conducting an Instructional Analysis

Following the educational theories derived from Dick and Carey, an instructional analysis is conducted. An instructional analysis requires an instructional goal to be placed into one of four domains of learning. These domains include: psychomotor skills, intellectual skills, verbal information and attitude. Based upon the job description of the photojournalist, the instructional goal is identified as an intellectual skill. Photojournalists are required to perform problem-solving activities that require cognitive thinking. Color images vary in content, exposure, and media effecting the separation process. The photojournalist is obligated to analyze original copy based upon the concepts inherent to quality color reproduction. This evaluation requires the photojournalist to apply problem-solving techniques for the determination of appropriate color separation procedures. Therefore, the instructional goal is classified as an intellectual skill.

The second step in conducting an instructional analysis, is the creation of an in-depth task analysis. Derived from the rules and concepts of the color separation process, this analysis reflects the interrelated tasks required of the photojournalist. Identifying the necessary tasks of the photojournalist assists the instructional designer in creating appropriate educational materials. A completed task analysis may be found in Appendix C.

Identifying subskills required to perform individual tasks completes the instructional analysis. Subskills are defined as prerequisite skills required for learning a higher skill. The subskills are identified to ensure separation concepts and rules are mastered. While these skills may seem mundane, their presence is imperative as they indicate what the learner must already know. Identification of subskills aids the instructional designer by providing a foundation for instruction. Greater skills may not be mastered without understanding the concepts that support their function. Through an analysis, these subskills include: concepts of quality exposures, selection of appropriate capture media, understanding characteristics of original copy, appropriate setup and operation of scanning technologies, color theory, and digital file preparation.

Identification of Entry Behaviors and Subordinate Skills

Prior to beginning instruction, learners possess a set of entry behaviors and subordinate skills. In searching for a common denominator that ties the group together, an analysis of entry behaviors and subordinate skills is conducted. This analysis is conducted to prevent education from beginning at an inappropriate level for the learner, and determine what types of behavioral characteristics are needed of the learner.

In 1998, The National Council for Skill Standards in Graphic Communications, in conjunction with the Graphic Arts Technical Foundation (GATF), published a report outlining a recommended "national voluntary skills standard for prepress/imaging operators in the graphic communications industry." This report was created through a desired need to define the subordinate skills required for prepress/imaging operators employed in a digital workflow environment. For imaging professionals within the publishing industry, core subskills are identified as: a basic knowledge of printing, mathematical, communication and core prepress skills. Entry behaviors inherent to imaging professionals include: thinking, interpersonal and organizational skills.

This report establishes required entry behavior characteristics needed for obtaining quality instruction. Through the recognition of these behaviors, an instructional designer implements professional educational material that achieves optimum results based upon an instructional goal.

When asked what he believed to be the most relevant entry behaviors required of the learner to receive quality learning, Mr. Watson stated, "Number one there has to be the interest. Secondly, some technical computer ability and a willingness to learn and improve."

A survey respondent stated, "The biggest factor in good color is having good people . . . if the people are good you can work around the other problems. If the people are not good, you are in trouble no matter what you do."

The identification of subordinate skills and entry behaviors common to the photojournalist (as the imaging professional) has been utilized in the creation of quality instructional material. The language used in the writing of this material is designed to express a conversational tone with the reader. Terms and definitions as they relate to color separations are written in a style that permits a clear understanding in the relationship between required tasks in color image processing systems, and the rules and concepts that govern them. The guide is designed and structured for the motivated learner who has a desire to receive quality educational material. The guide may be used by the novice practitioner as a means of obtaining the concepts and theories inherent to their work. In addition, the chapters of the guide outline a proposed color imaging workflow suitable for quality color reproduction. The learner may use the guide as resource material by reviewing individual chapters devoted to specific rules and concepts. Additional material is supplied within the guide that addresses theories of color, image capture and operational procedures that relate to quality color reproduction. This material has been supplied based on the identification of motivational behaviors of the learner. This materials supplies the reader with the opportunity to learn additional graphic arts reproduction theory as it related to their profession.

Design of Program Content

The educational model selected for this material is based on the work of Charles Layne. Layne emphasizes the incorporation of educational material into units containing modules representing concepts and skills necessary for completing instructional goals. Each task within the instructional analysis represents a single unit. Concepts and rules that support the task are separated into modules of instruction inside the unit. A module, based on the work of Layne, is located in Appendix D.

To achieve quality learning, Layne suggests an early identification of concepts inherent throughout instruction. Doing so aids the learner in grasping new skills as they are introduced throughout the learning module.

Finally, Layne supports the identification of concepts that may not seem of importance to the instructional goal. Quite often these concepts may be taught under a different curriculum. However, these concepts assist in the understanding of rules and concepts utilized in the instructional analysis. These concepts include aspects of print production that may assist the photojournalist in creating quality separations. Following Layne's model, concepts of dot gain, UCR/GCR settings, RGB and CMYK color spaces, and ink color table settings are addressed.

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Appendix

Appendix A

Newspapers in the United States with a Daily Circulation of 300,000 and Above Based on a Circulation September 30, 1999. According to *Editor and Publisher International Yearbook: 1999.*

New York (NY) *Wall Street Journal**	1,752,693
Arlington (VA) *USA Today*	1,671,539
New York (NY) *Times*	1,086,293
Los Angeles (CA) *Times*	1,078,186
Washington (DC) *Post*	763,305
New York (NY) *Daily News*	701,831
Chicago (IL) *Tribune*	657,690
Long Island (NY) *Newsday*	574,941
Houston (TX) *Chronicle*	542,414
Dallas (TX) *Morning News*	490,249
Chicago (IL) *Sun Times*	468,170
Boston (MA) *Globe*	462,850
San Francisco (CA) *Chronicle*	456,742
New York (NY) *Post**	438,158
Phoenix (AZ) *Arizona Republic*	433,296
Newark (NJ) *Star Ledger*	407,129
Philadelphia (PA) *Inquirer*	399,339
Denver (CO) *Rocky Mountain News*	396,114
Cleveland (OH) *Plain Dealer*	386,312
San Diego (CA) *Union-Tribune*	376,604
Denver (CO) *Post*	376,549
Detroit (MI) *Free Press*	365,145
Orange County (CA) *Register*	358,754
Miami (FL) *Herald*	349,114
Portland (OR) *Oregonian*	347,538
St. Petersburg (FL) *Times*	336,821

Minneapolis (MN) *Star Tribune*	336,510
Baltimore (MD) *Sun*	314,819
Atlanta (GA) *Constitution*	307,667
St. Louis (MO) *Post-Dispatch*	303,314

* *These publications were not contacted as they do not produce 4-color process printing.*

Appendix B

Questionnaire designed for data collection from the top U.S. daily newspapers based on a circulation of 300,000 and higher.

R·I·T

Rochester Institute of Technology

School of Printing Management
and Sciences
College of Imaging Arts and Sciences
Frank E. Gannett Building
69 Lomb Memorial Drive
Rochester, NY 14623-5603
716-475-2728 Fax 716-475-7029

The material within this questionnaire will be used for the completion of MS graduate studies within the Graphic Arts Publishing Program at the Rochester Institute of Technology. Information within this questionnaire is confidential and shall only be used for the gathering of facts regarding operational procedures of color image processing software. There will be no specific mention of the newspaper organization, your department, or you as an individual.

To complete this questionnaire, please print out the attached PDF survey and fax your responses to Greg Kimmich, care of RIT at 716.239.6087. In appreciation for your involvement, you will be sent a copy of *Print 2020*. This book has been written and published by graduate students enrolled in the RIT Graphic Arts Publishing Program. The publication discusses current trends within the printing industry, and provides insight into how new technologies may effect industry in the coming years.

Once again, thank you for your time and cooperation.

Sincerely;

Greg Kimmich

gskrc@rc.rit.edu

716.256.3419 (home)

716.239.6087 (fax)

The following questionnaire has been designed for the identification of quality failures in color image reproduction in newsprint. The questions asked will attempt to better define the problems, locate the needs, and assist in the development of educational material designed to assist newspaper photojournalists in the operational procedures for color image preparation. These materials will focus on appropriate workflow procedures and the concepts that support their operations.

1. Please indicate your job title.

2. Please describe your primary responsibilities within the department.

3. From the following samples, please indicate which sources your department uses for image acquisition. In addition, please identify the approximate percentage used on a daily basis (i.e. traditional-35%, digital-15%, wire-10% etc.)

- ❒ Traditional film
- ❒ Wire news services
- ❒ Digital
- ❒ Reflection copy
- ❒ Internet
- ❒ Other, *please elaborate*

Please go to next page →

4. Are you pleased with the results of the color image processing software used within the department (please select one box)?

❐ Always

❐ Usually

❐ Not often

❐ Almost never, *please elaborate*

5. Have you and your staff been trained in the operational procedures of your color image processing software?

❐ Yes ❐ No, *please go to #8*

6. How effective was the training?

❐ Highly effective

❐ Somewhat effective

❐ Not really effective

❐ Ineffective, *please elaborate*

7. Was the training provided internally or from an outside consultant?

- ☐ Internally
- ☐ Both
- ☐ Outside consultant
- ☐ Other, *please elaborate*

8. Is there an individual who serves as a quality assurance representative for color reproduction within the department?

- ☐ Yes
- ☐ No

9. Does your organization currently have, or plan to implement a color management system?

- ☐ Yes
- ☐ We are planning on implementing a system.
- ☐ No

10. Please indicate the workflow procedures you follow when adjusting an image. Please rank from one through eight, with the first step indicated as one.

- ☐ RBG to CMYK conversion
- ☐ Establishing neutrality
- ☐ Placement of white point
- ☐ Image size adjustment
- ☐ Placement of dark point
- ☐ Contrast adjustment
- ☐ Sharpening
- ☐ Other, *please elaborate*
- ☐ Color correction

11. Please indicate any of the listed concepts that you believe you or your staff may <u>not</u> fully understand.

- ❐ Quality exposures
- ❐ Neutrality
- ❐ Color theory
- ❐ Tonal adjustments
- ❐ Unsharp masking
- ❐ Keyness of original image

12. Are there any departments outside of the photography department that make adjustments to the image file after you have made changes?

- ❐ Yes, *please indicate the department*
- ❐ No

13. On average, about how much time does your staff spend adjusting an image for production?

14. Do you believe this is an appropriate amount of time?

- ❐ Too much time
- ❐ Too little
- ❐ About right

15. After print production, what percentage of images do you believe could have been produced with better quality?

❒ 10 - 20% ❒ 50 - 60% ❒ 80 - 90%

❒ 20 - 30% ❒ 60 - 70% ❒ 90 - 100%

❒ 40 - 50% ❒ 70 - 80% ❒ Other, *please elaborate*

16. After an image has been printed, what printing defects have you noticed (i.e. loss of detail, contrast, resolution, color correction, neutrality, etc.)?

17. Do you believe these printing defects are primarily do to color image processing software operations or pressroom operations, prepress operations, communication problems, etc.?

❒ Pressroom operations ❒ Communication between press & prepress

❒ Prepress operations ❒ Wire service images, previously adjusted

❒ Image Capture ❒ Other, *please elaborate*

Just about finished →

18. Do you believe there is a need for educational material regarding color image processing operations designed specifically for the photojournalist?

- ☐ Yes
- ☐ No, *please go to #22*

19. What aspect(s) of color image processing operations do you feel are most appropriate for educational material? Please rank, from one to seven, with the most relevant topic selected as one.

- ☐ Color correction
- ☐ Contrast adjustment
- ☐ Sharpening
- ☐ Image size adjustment
- ☐ Placement of white point
- ☐ Placement of dark point
- ☐ Neutrality
- ☐ Other, *please elaborate*

Almost Done →

20. Please indicate, in rank order (with one being the first choice) the methods of education you feel are most appropriate for instruction of color image processing software operations.

- ❐ CD-ROM tutorials
- ❐ An outside consultant
- ❐ Lectures
- ❐ Workshops
- ❐ Hands-on exercises
- ❐ Other, *please elaborate*
- ❐ Printed manuals with step-by-step procedures

21. Based on your preferred methods of education, how much time do you believe you could allow for training within a week's time?

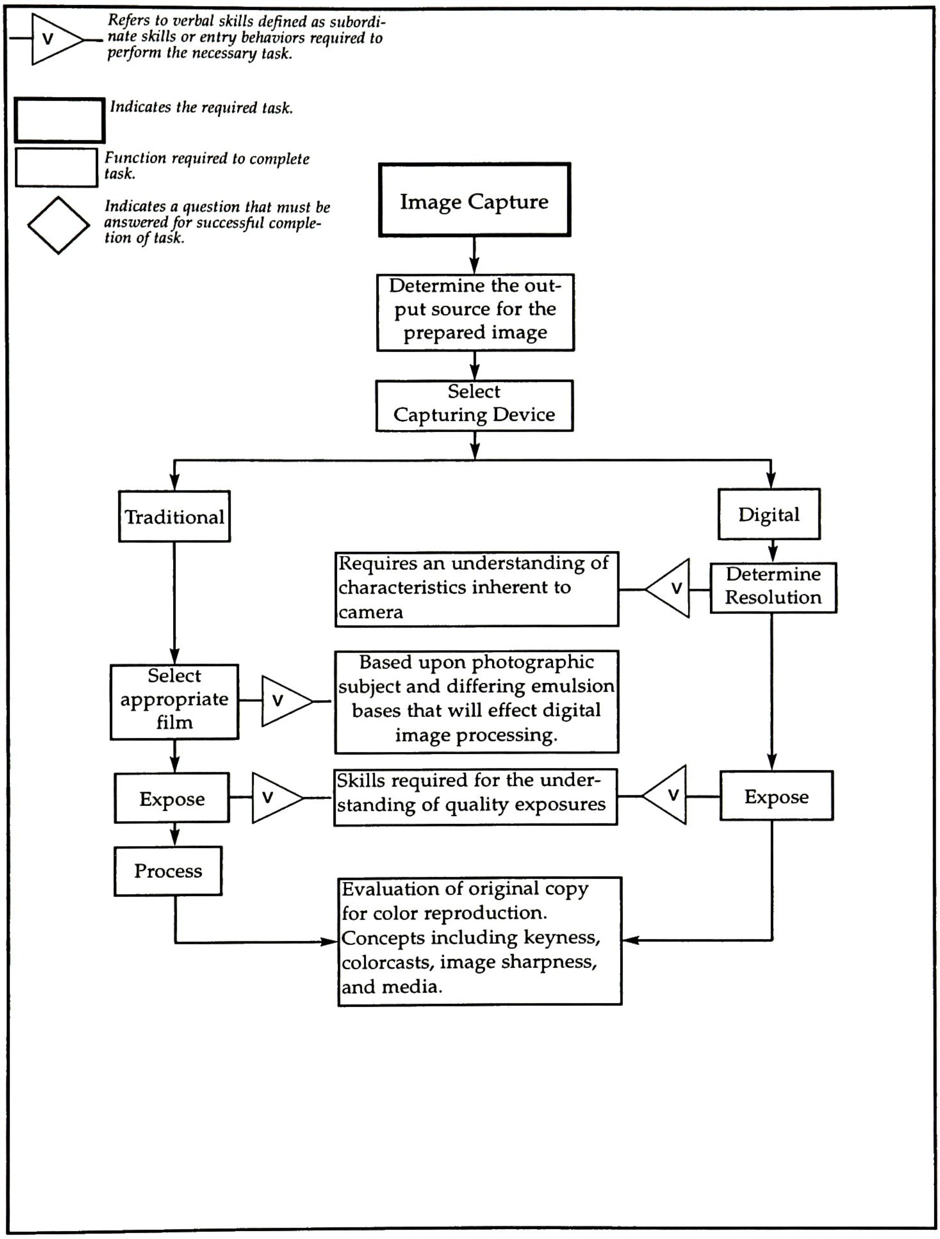
22. Please feel free to add any additional comments regarding this survey and/or other issues your paper faces in processing images for production.

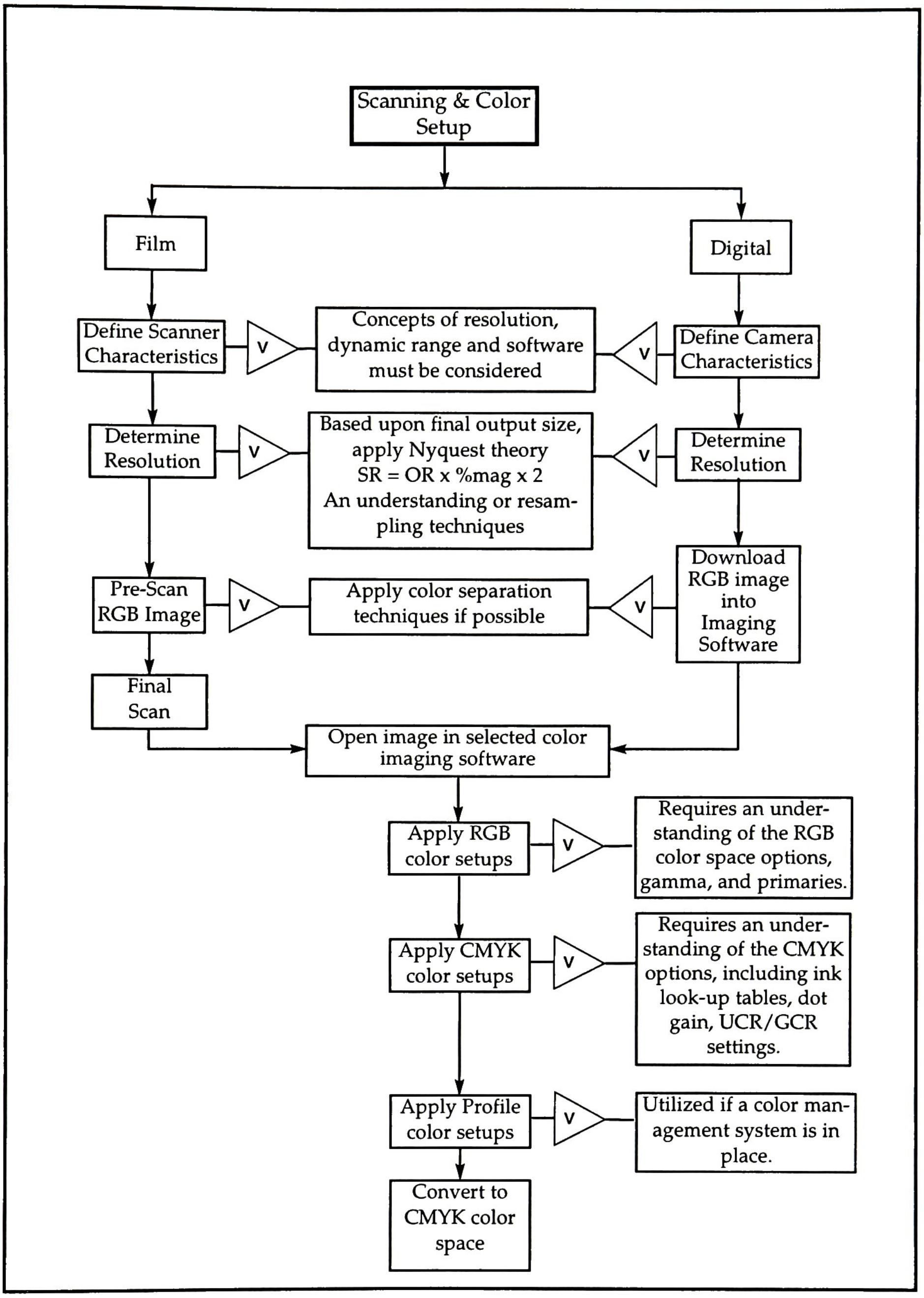
Thank you for your time and cooperation.

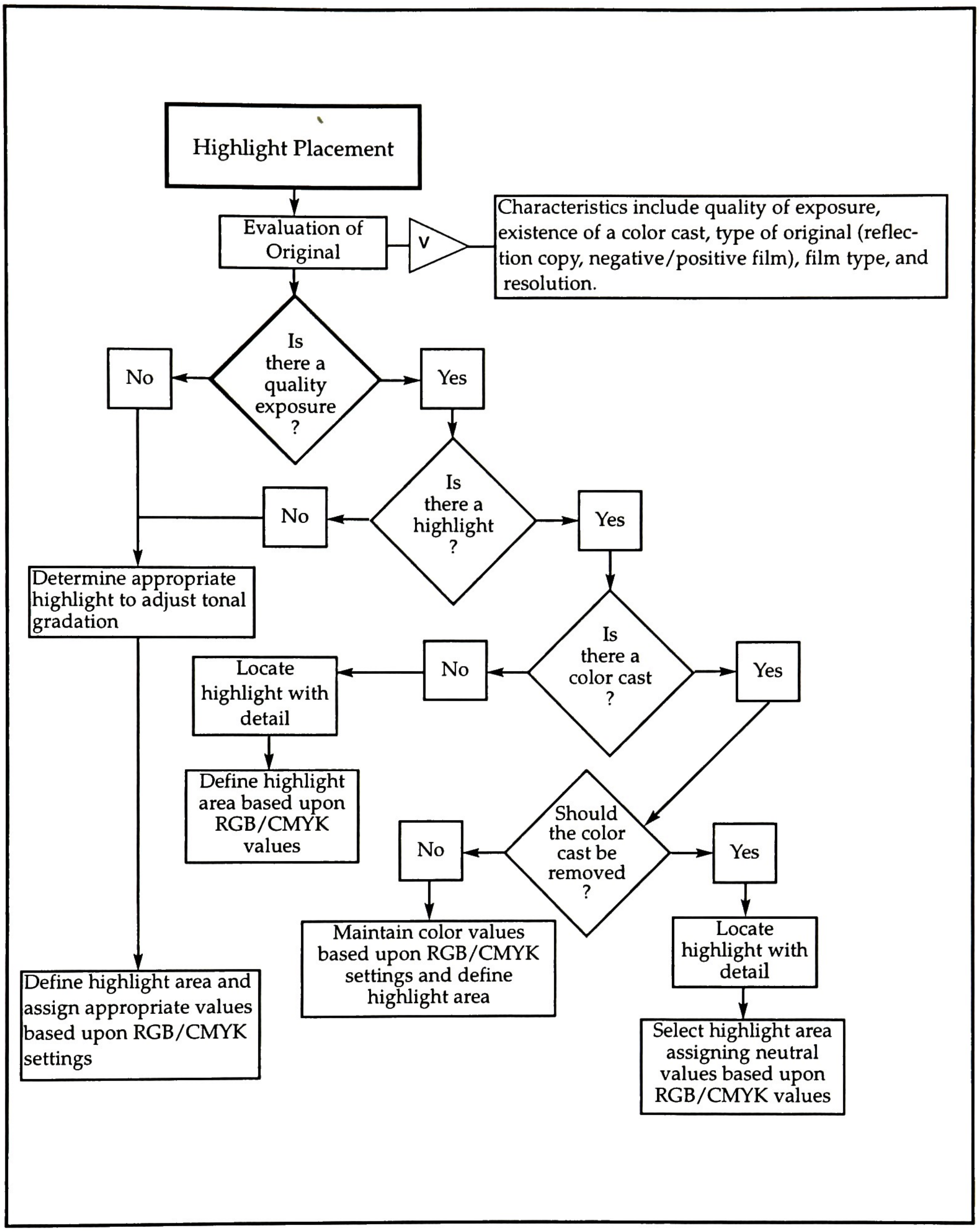
Appendix C

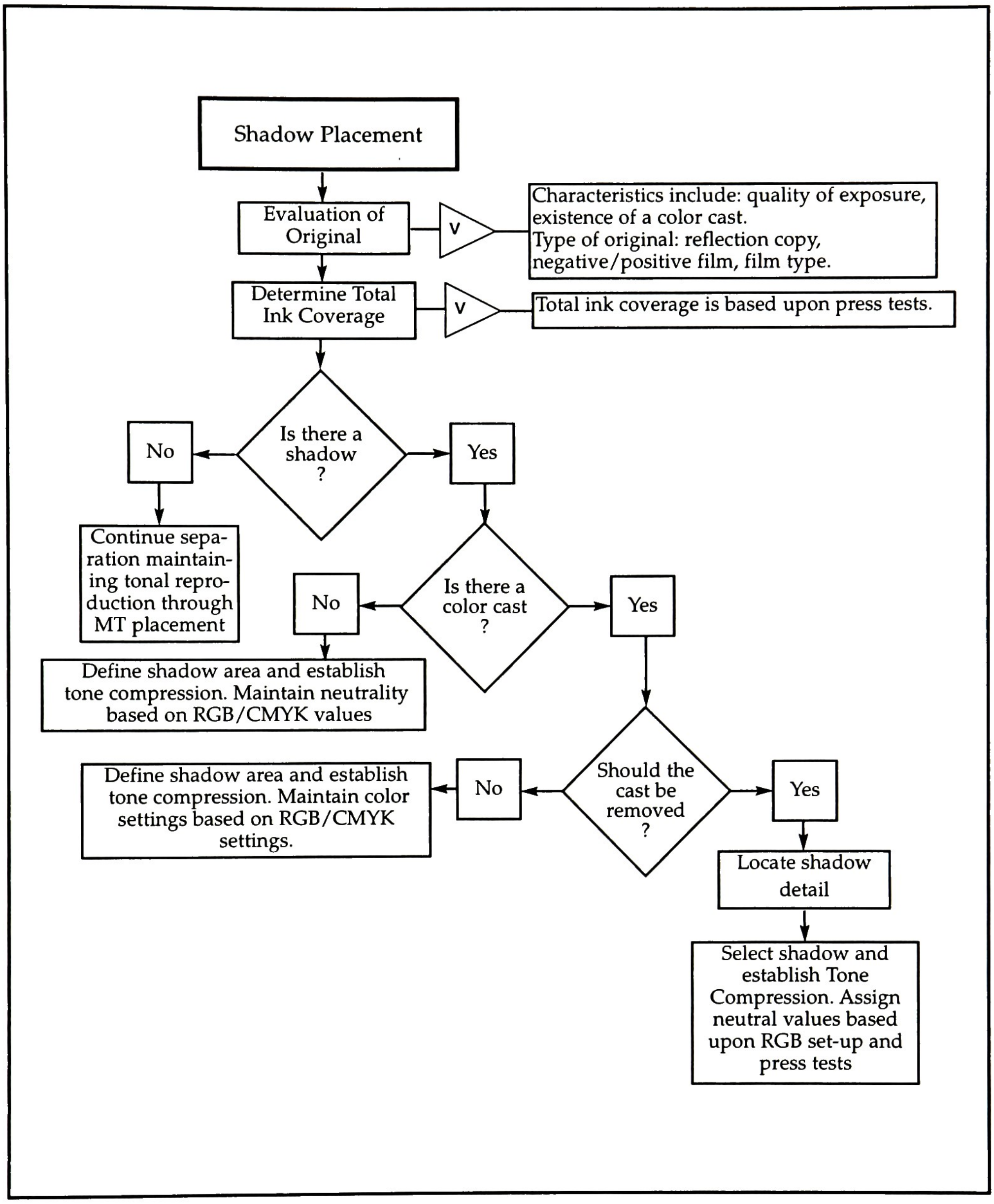
Task Analysis of Color Image Processing Procedures

Carey, Lou, and Walter Dick. *The Systematic Design of Instruction*. Glenview: Scott, Foresman and Company, 1990: p. 48-80.

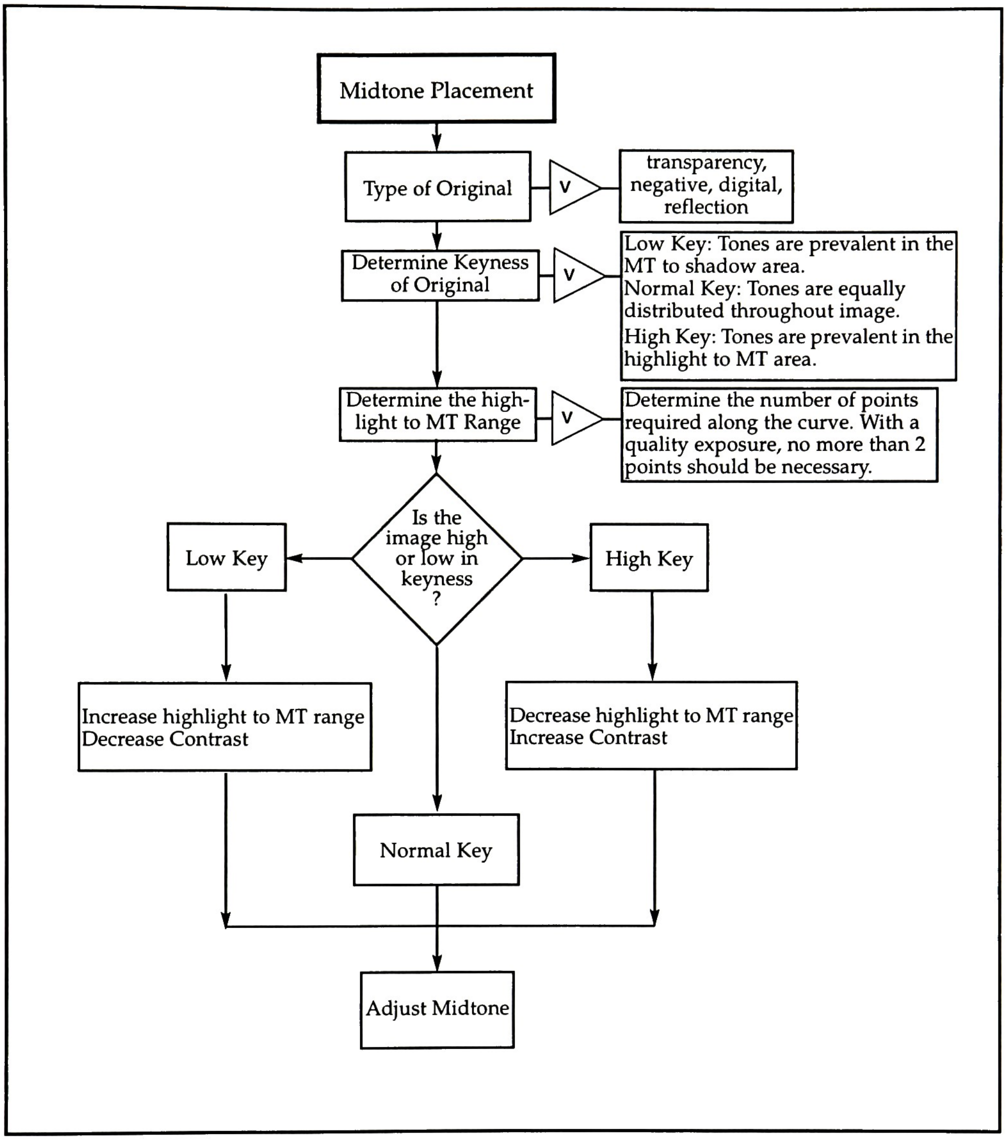


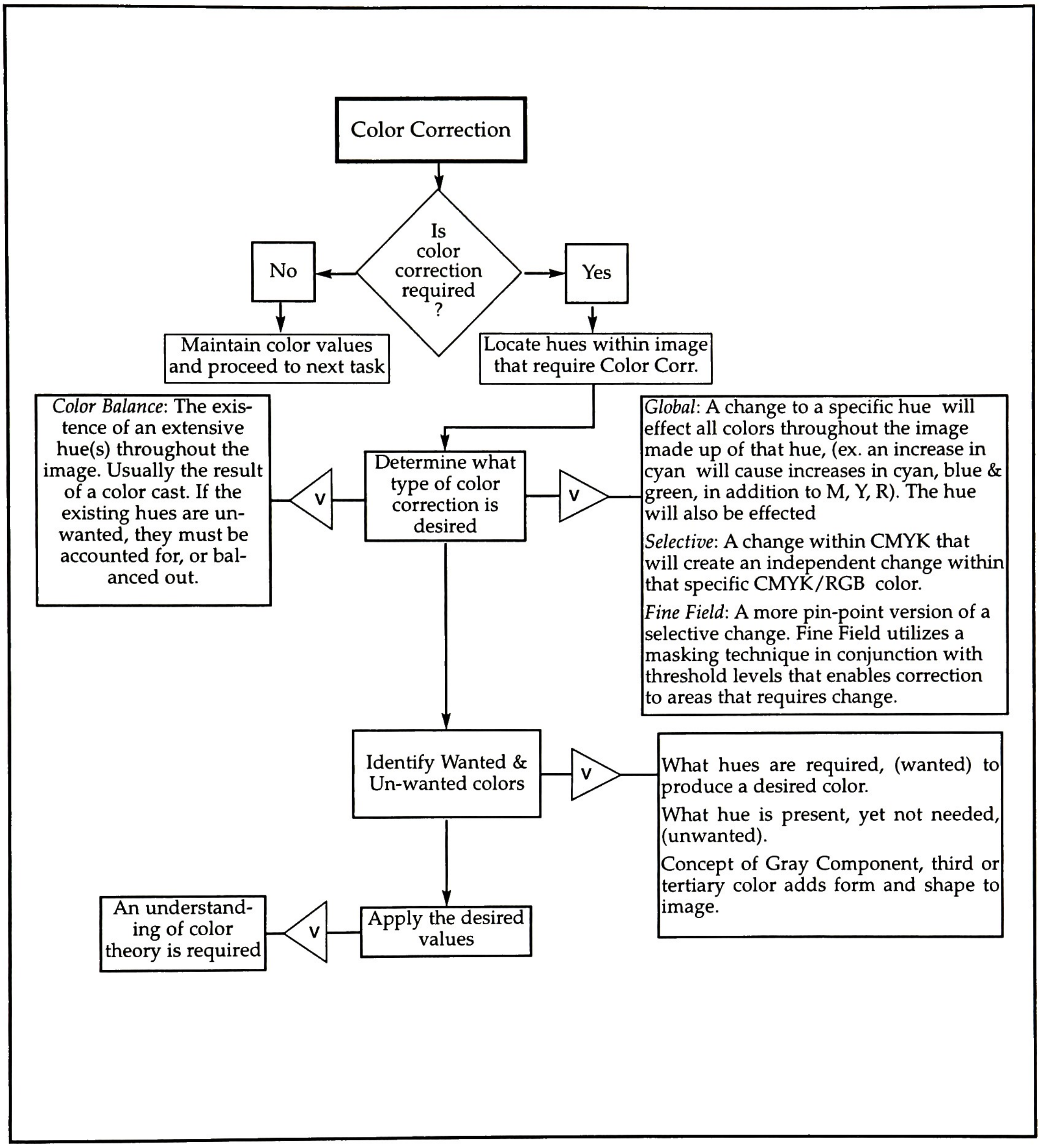

Scanning & Color Setup
Film
Digital
Define Scanner Characteristics
V
Concepts of resolution, dynamic range and software must be considered
V
Define Camera Characteristics
Determine Resolution
V
Based upon final output size, apply Nyquest theory SR = OR x %mag x 2 An understanding or resampling techniques
V
Determine Resolution
Pre-Scan RGB Image
V
Apply color separation techniques if possible
V
Download RGB image into Imaging Software
Final Scan
Open image in selected color imaging software
Apply RGB color setups
V
Requires an understanding of the RGB color space options, gamma, and primaries.
Apply CMYK color setups
V
Requires an understanding of the CMYK options, including ink look-up tables, dot gain, UCR/GCR settings.
Apply Profile color setups
V
Utilized if a color management system is in place.
Convert to CMYK color space

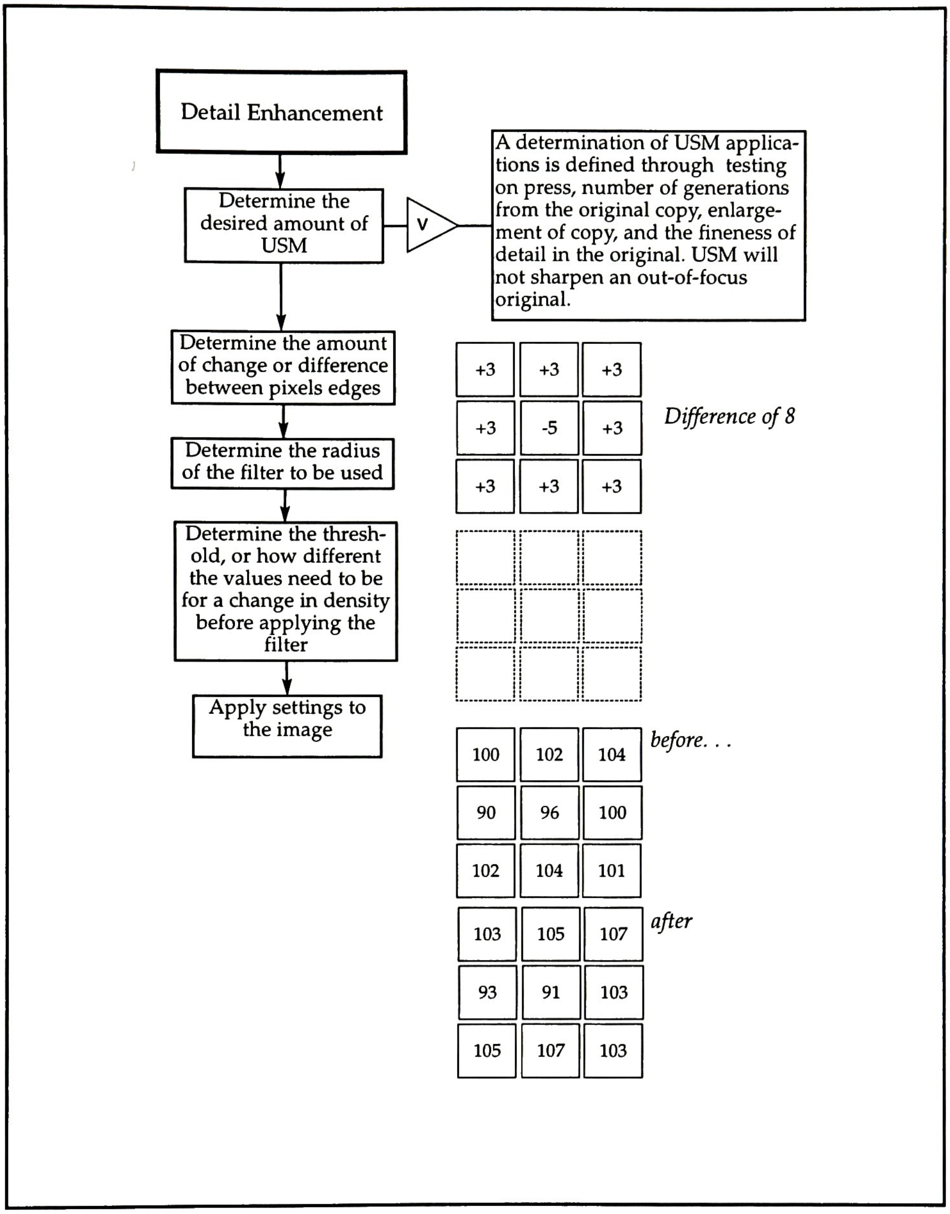

Highlight Placement
Evaluation of Original
V
Characteristics include quality of exposure, existence of a color cast, type of original (reflection copy, negative/positive film), film type, and resolution.
Is there a quality exposure ?
No
Yes
Is there a highlight ?
No
Yes
Determine appropriate highlight to adjust tonal gradation
Is there a color cast ?
No
Yes
Locate highlight with detail
Define highlight area based upon RGB/CMYK values
Should the color cast be removed ?
No
Yes
Maintain color values based upon RGB/CMYK settings and define highlight area
Locate highlight with detail
Select highlight area assigning neutral values based upon RGB/CMYK values
Define highlight area and assign appropriate values based upon RGB/CMYK settings



Shadow Placement
Evaluation of Original
V
Characteristics include: quality of exposure, existence of a color cast.
Type of original: reflection copy, negative/positive film, film type.
Determine Total Ink Coverage
V
Total ink coverage is based upon press tests.
Is there a shadow ?
No
Yes
Continue separation maintaining tonal reproduction through MT placement
Is there a color cast ?
No
Yes
Define shadow area and establish tone compression. Maintain neutrality based on RGB/CMYK values
Should the cast be removed ?
No
Yes
Define shadow area and establish tone compression. Maintain color settings based on RGB/CMYK settings.
Locate shadow detail
Select shadow and establish Tone Compression. Assign neutral values based upon RGB set-up and press tests


Midtone Placement
Type of Original
V
transparency, negative, digital, reflection
Determine Keyness of Original
V
Low Key: Tones are prevalent in the MT to shadow area.
Normal Key: Tones are equally distributed throughout image.
High Key: Tones are prevalent in the highlight to MT area.
Determine the highlight to MT Range
V
Determine the number of points required along the curve. With a quality exposure, no more than 2 points should be necessary.
Is the image high or low in keyness ?
Low Key
High Key
Increase highlight to MT range
Decrease Contrast
Decrease highlight to MT range
Increase Contrast
Normal Key
Adjust Midtone


Color Correction
Is color correction required ?
No
Yes
Maintain color values and proceed to next task
Locate hues within image that require Color Corr.
Determine what type of color correction is desired
V
Color Balance: The existence of an extensive hue(s) throughout the image. Usually the result of a color cast. If the existing hues are unwanted, they must be accounted for, or balanced out.
Global: A change to a specific hue will effect all colors throughout the image made up of that hue, (ex. an increase in cyan will cause increases in cyan, blue & green, in addition to M, Y, R). The hue will also be effected
Selective: A change within CMYK that will create an independent change within that specific CMYK/RGB color.
Fine Field: A more pin-point version of a selective change. Fine Field utilizes a masking technique in conjunction with threshold levels that enables correction to areas that requires change.
Identify Wanted & Un-wanted colors
What hues are required, (wanted) to produce a desired color.
What hue is present, yet not needed, (unwanted).
Concept of Gray Component, third or tertiary color adds form and shape to image.
Apply the desired values
An understanding of color theory is required



Detail Enhancement
Determine the desired amount of USM
V
A determination of USM applications is defined through testing on press, number of generations from the original copy, enlargement of copy, and the fineness of detail in the original. USM will not sharpen an out-of-focus original.
Determine the amount of change or difference between pixels edges
Determine the radius of the filter to be used
Determine the threshold, or how different the values need to be for a change in density before applying the filter
Apply settings to the image
+3 +3 +3
+3 -5 +3
+3 +3 +3
Difference of 8
100 102 104
90 96 100
102 104 101
before. . .
103 105 107
93 91 103
105 107 103
after

Appendix D

Modular Approach to Education based on the theories of Charles Layne

Layne, Charles. "In-Plant Training for Company-Wide Quality," in *Quality and Productivity in the Graphic Arts.* ed. Miles Southworth and Donna Southworth, Livonia, NY, 1990: p. 23-1–23-26.

Content for Educational Material Designed for Photojournalists
Unit 1.0 Introduction Module 1.1 Overview of Material to be Discussed Module 1.2 Understanding of Color Spaces and Gamuts Module 1.3 Introduction to Color Separation Concepts
Unit 2.0 Image Capture Module 2.1 Importance of Image Capture Module 2.2 Traditional versus Digital Photography Module 2.3 Concepts Required in the Evaluation of Original Copy
Unit 3.0 Scanning and Color Setup Module 3.1 Characteristics of Quality Scanning Operations Module 3.2 Dynamic Range Module 3.3 Software Module 3.4 Resolution Module 3.5 File size Module 3.6 Resampling Module 3.7 Color Setup Module 3.8 Color Setting Presets Module 3.9 RGB Working Space Module 3.10 CMYK Working Space Module 3.11 Grayscale Settings Module 3.12 Color Management Policies
Unit 4.0 Highlight Placement Module 4.1 Characteristics and Definition of Highlight Module 4.2 Evaluation of Original Module 4.3 Concept of Gray Balance Module 4.4 Concept of Colorcasts
Unit 5.0 Shadow Placement Module 5.1 Concept of Tone Compression Module 5.2 Types of Original Module 5.3 Gray Balance and Total Ink Coverage Module 5.4 Evaluation of Original

Unit 6.0 Midtone Placement Module 6.1 Definition of Midtone Module 6.2 Concept of Keyness Module 6.3 Concept of Tone Reproduction Module 6.4 Concept of Dot Gain
Unit 7.0 Color Correction Module 7.1 Concept of Hue Error Module 7.2 Un-Wanted & Wanted Colors Module 7.3 Evaluation of Original Module 7.4 Global, Selective & Fine Field Adjustments
Unit 8.0 Detail Enhancements Module 8.1 Concept of USM Module 8.2 Evaluation of Original Module 8.3 Radius Module 8.4 Amount Module 8.5 Threshold

Appendix E

Quality Desktop Color Separations for the Photojournalist

Introduction

beginning

This guide has been designed for the photojournalist working in color prepress newspaper operations. The chapters that follow outline and discuss concepts and procedures inherent to quality color reproduction. Whether you are just entering the field of photojournalism, or a veteran of the trade, this guide serves as both a reference manual and instructional guide for understanding the electronic color separation process.

The color separation process is performed for the conversion of RGB (additive) color into its nearest equivalent CMYK (subtractive) color space. Performed within color image processing software, this translation provides the values for color reproduction within the CMYK color space. Cyan values are derived from the red channel, magenta from green, and yellow from blue. The combination of RGB provides the appropriate K, or black channel.

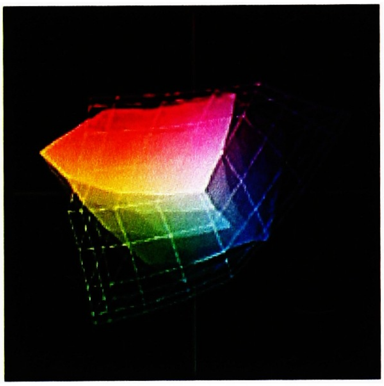


Figure 1: An illustration of an RGB color gamut (wire frame) and a CMYK color gamut within the CIELAB color space. (Illustration by Dr. Gus Braun)

The color separation process is simplistic, however CMYK and RGB color spaces are made from different color gamuts within the visible spectrum. Gamuts refer to the range of colors a specific device (input or output) can render within a given color space. Cameras and monitors (RGB) and proofing or printing devices (CMYK) use different color gamuts See figure 1. A useful analogy would be that of a box of crayons, the more colors at your disposal, the larger range or gamut within an array of possible colors. A box of 24 various colored crayons might represent a CMYK gamut, as a larger number of 36 different colors would then be representative of an RGB gamut.

Production environments implementing color management systems often utilize the CIELAB color space. CIELAB is a three dimensional color space that often serves as an independent color space for the transition of RGB into CMYK working spaces. In effect, CIELAB translates color information between varying color (RGB and CMYK) imaging devices. When an image is captured or scanned as RGB, the color information is converted into CIELAB values referred to as L*, a* and b*. As an image is prepared for output, its CIELAB values are translated to their corresponding CMYK values to be printed with the appropriate colors. The objective of creating a quality separation is to get an acceptable reproduction on press or in print. Utilizing the CIELAB color space as a translator of color information between imaging devices assists in reaching that objective.

Many newspaper organizations incorporate a color management system in their workflow. Color management addresses the need for acceptable color matching within the prepress and printing process. Color management systems link prepress and production operations to ensure proper color reproduction.

Fundamentally, color management aids in the matching of original color(s) to those produced by scanning, monitor, proofing and final press run operations. This guide does not discuss color management systems in detail. Rather, it addresses the requirements for quality color separations desirable within any color reproduction system.

Quality color separations are based upon the following concepts: image capture, gray balance, tone compression, tone reproduction, color correction, and image sharpness. This guide will discuss these concepts in detail, addressing the rules and theories that support their actions. These concepts are critical in the separation process as they compensate for characteristics of print production and the translation of color spaces.

A number of challenges are encountered in reproducing color images on newsprint. Challenges include the conversion of RGB to CMYK color, limitations in rendering tonal densities, and printing manifestations. Manifestations include dot gain, the growth of the printing dot during production, and hue error (the presence of wanted and unwanted colors within inks). These challenges are all part of image production, and will be addressed in the following chapters.

As previously stated, photojournalists work in a different color gamut than that of the printer. Professional color separation techniques assist in the translation of color values between the two gamuts.

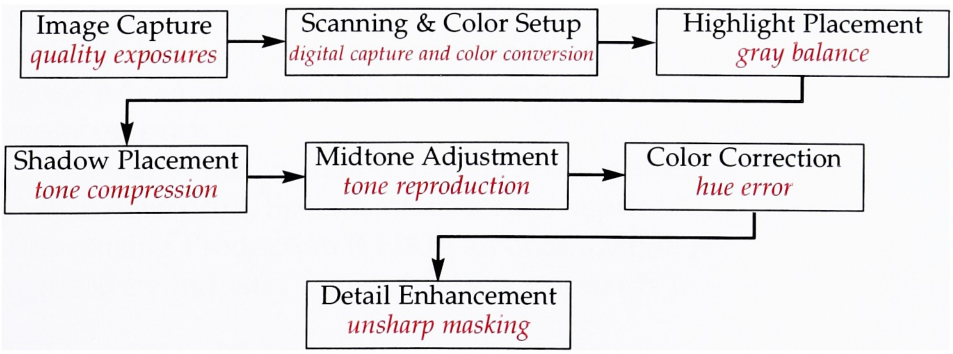
Additional challenges lie with rendering appropriate tonal densities captured via film or digital photography. Tonal density range refers to the amount of distinguishable tonal values imaged on a scale from 0.0 at the lightest values to 4.0 at the darkest value. The tonal density range of film is approximately 3.0. The tonal density range reproducible on newsprint is closer to 1.2. Tonal compression (discussed in the following chapters) is applied in the separation process to account for limited tonal ranges on press.

Midtone adjustment (discussed in chapter 6) in the separation process compensates for image keyness and dot gain. Keyness, the arrangement of tonal values throughout an original, must be analyzed and reproduced with the appropriate visual contrast. Midtone adjustment will also compensate for dot gain, which is the growth or expansion of the halftone dot in the platemaking and production process.

Loss of detail is evident in both the photographic and printing process. Degradation to detail occurs in each generation produced beyond an original image. In addition, the rendering of a continuous tone image onto a porous substrate such as newsprint results in the loss of detail. Software tools utilized within the color separation process will assist in detail enhancement.

Color correction techniques are applied in the separation process to compensate for hue error within ink sets. Hue error is defined as the presence of additional colorants within ink. These colorants are portions of ink not required or wanted in the specifications of an individual ink. For example, a unit of cyan ink contains portions of magenta and yellow ink. The yellow and magenta inks are referred to as the unwanted colors; cyan is the wanted color. The concepts and procedures for quality color correction will be discussed in chapter 7.

This book outlines a recommended workflow for achieving quality color separations. The diagram below reflects the proposed workflow and their underlying concepts.



The job of the photojournalist has been redefined. Job responsibilities now include the creation of electronic desktop color separations. As the separator, photojournalists utilize an array of powerful tools in preparing images for production. However, a quality reproduction is not obtainable if the original image was not properly exposed. The old adage, "garbage in   garbage out" strictly applies in color image processing. This chapter discusses guidelines appropriate for quality image capture, including an understanding of desired output devices, and the ability to evaluate original copy in terms of keyness, colorcasts, sharpness, and physical conditions.

Photographic films are able to capture a density range of approximately 3.0. In comparison, the total density range of commercial offset printing is approximately 1.8. Imaging on a porous substrate such as newsprint decreases the total density range to 1.2. See figure 1. Therefore, the key to creating a quality color separation is accurately reproducing the density range from a photographic image within the density range on press.

Figure 1: A tonal range of 3.0. representative of traditional photography.

Figure 1a: A tonal range of 1.2. representative of newsprint production.

To assist in the creation of quality color reproduction in newsprint, Specifications for Newsprint Advertising Production (SNAP) an organization recognized by industry for establishing standards in quality color reproduction, recommends that photojournalists aim for midtone areas during image capture. While production specialists refer to density as percent dot areas, photojournalists view density as a range of varying exposure on film or CCD. For the photojournalist, these exposure areas are referred to as f/stops. One f/stop is equivalent to .30 in print density on press. Therefore, if a photojournalist were to capture an image that encompassed a range of four stops, the total density range of that image is 1.2 (1.2/0.30 = 4). Knowing that our output device only renders the darkest shadow area at a density of 1.2, this example illustrates the importance of total density as it relates to production. Whenever possible, it is recommended that the photojournalist capture a density range of two to three f/stops for a quality reproduction.

Technical advances in digital photography have enabled photojournalists to increase workflow production by decreasing time in prepress operations. In addition, digital photography has required the photojournalist to understand the concept of tone compression as it relates to production. Photographers are able to view their work immediately through an LCD module on the camera back. Using a histogram as a guide, the photographer is able to locate the captured tonal range, and determine if it is appropriate for print production.

Regarding image capture, a digital camera obtains resolution in terms of pixels, and defines the dynamic range, or bit depth of an image. High-end digital cameras can capture an image with a resolution of 2 x 2 megapixels (1,000 pixels = 1 megapixel) or, 2,048 x 2,048 ppi. Additionally, suitable gray levels are achieved through a bit depth of 12 bits per channel. It should be noted that when selecting a digital camera or scanner, one should determine if the values stated for resolution and bit depth levels are represented as individual channels (12 bits per channel) or collectively as 36 bit. To illustrate this point, the above digital camera may be advertised as having the ability to capture a bit depth of 36 bits. However, the true value for bit depth is 12 bits per channel.

Preparing an image for reproduction requires an evaluation of the original. In analyzing the image, there must be a determination as to the quality of the exposure. As the separator, you must judge if the image has been over-or under exposed. If so, you must compensate for the exposure in tonal compression and midtone gradation through an adjustment of highlight placement.

Continuing the analysis, there must be a definition of the overall keyness of the image. Keyness refers to the predominant location of tonal information within the image. A histogram will map out these areas providing a visual reference to tonal location.

When viewing the analog original, note if a colorcast exists. A colorcast is the presence of an unwanted color throughout an image. Colorcasts are possible for a variety of reasons including: improper exposure, lighting conditions, characteristics of film and film processing techniques. Colorcasts are most prevalent in the highlight area. If a cast is located, it affects the color of the entire image, prohibiting a quality reproduction. When evaluating the color characteristics of an original, the analysis should be conducted under appropriate lighting conditions. A viewing booth utilizing a 5000°K light source should be used. Designed to match standard daylight viewing conditions, a 5000°K light source has been accepted as an industry standard for viewing production of color printing.

If the original is in a digital format, color values should be evaluated on the monitor within the color imaging software and adjusted based on the amounts of wanted and unwanted colors within the image. Computer monitors should be calibrated to reflect your work environment, however using the color values provided within the software provides an objective method for the determination of wanted and unwanted colors.

Examine the overall sharpness of the original. If the original is out-of-focus, you will not be able to enhance the detail or sharpen the image. Detail enhancement may be applied, however, if no detail was captured, then image sharpening is not possible. Detail enhancement will be necessary in any production, however, getting a feel for the amount of detail in the image provides you with a reference point for how much enhancement to apply in the separation process. Evaluate the media used to create the original. Originals may consist of reflection copy, transparencies, negatives, or electronically acquired through a digital camera or scanner. Consider the grain of film or print media, or the resolution of a digital file. Visualize the difference between an image caught on T-MAX™ 3200 speed film versus a film rated at an ISO of 200. If substantial amounts of film/print grain (traditional photography), or inadequate pixel information (digital photography) exists within the image, concepts of resolution and image sharpness will be effected. The grain of a high-speed film or lack of digitally sampled information will be more apparent through increased resolution and detail enhancement.

Finally, make sure copy, scanner bed, and camera optics are free of dirt, fingerprints, or scratches. Scanning will capture these artifacts and prove detrimental to the separation process. Software may offer tools to compensate for these manifestations, however, you will save a great amount of time by not capturing them in the first place.

Scanning and Color Setup

digital conversion

After the editing and evaluation process, the analog original is prepared for scanning. Three critical factors define quality characteristics inherent to scanning operations: dynamic range, software and resolution. These factors, necessary for the acquisition of quality scans in addition to the application of professional color setup procedures within imaging software, are reviewed in this chapter.

The dynamic range of a scanner defines the maximum tonal values that may be captured from the lightest to darkest areas of an image. Dynamic range also addresses the ability to distinguish varying tonal values within the range.

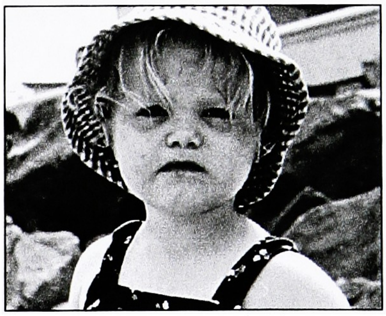
Bit depth describes the number of tones recorded from each sample. The larger (or deeper) the bit, the greater amount of color information and intermediate tones captured. These intermediate tones are referred to as gray levels within the recorded sample. A bit depth of eight is equivalent to 256 gray levels (2^8); a bit depth of twelve is equal to 4,096 gray levels (2^{12}). This concept is critical for rendering gradations or blends within an image.

Without the appropriate bit depth level, gradations are extremely difficult

Figure 3-1
Bit depth

1-bit, 2 gray levels

4-bit, 16 gray levels



8-bit, 256 gray levels

to produce. See figure 3-1. For newspaper production, SNAP recommends that output devices (imagesetters, proofers, and platesetters) render at least 142 gray levels. The formula endorsed by SNAP for determining the required gray levels is stated as:

$$\text{gray steps} = (\text{output resolution}/\text{lpi})^2$$

As an example, if an imagesetter is imaging at 1016 dpi, at a line screen ruling (lpi) of 85, our result is:

$$(1016/85)^2 = 142 \text{ gray levels.}$$

Software is the second factor inherent to professional scanning techniques. The "user friendliness" of the software and its color processing functionality must be evaluated. In assisting production workflow, scanning software often incorporates features inherent to color separation techniques. These features include: image sharpness, color settings, midtone gradation, selection of white and dark points, media selection, magnification and resolution. These functions allow the separator to address issues of detail enhancement, RGB/CMYK color conversions, tone reproduction, tonal values, percent dot areas, enlargement and file size concerns. These features, which will be outlined in following chapters, ease the scanning process if recognized.

Within the color separation workflow, resolution holds additional meanings. Pixels per inch (ppi) relate to the number of pixels per inch on your monitor, or captured through digital photography. After an image is scanned, sample information is digitally represented through varying pixels. Color imaging software will refer to resolution in terms of pixels per inch as the appropriate unit of measurement. In our workflow, resolution is regarded in four unique ways, spi, ppi, dpi, and lpi.

Samples per inch (spi) refers to the total number of samples (soon to be pixels) recorded from a continuous tone image. For a quality reproduction on press, an appropriate number of samples must be recorded. A formula has been developed for acquiring the necessary samples in scanning operations. The formula is stated as: Scanning Resolution (SR) = Output Resolution (OR) multiplied by percent magnification (%M) multiplied by Quality Factor (QF).

$$SR = OR \times \%Mag \times QF$$

Based upon screen rulings utilized on press, the value for quality factor varies. If a press is running at a screen ruling (or lpi) of 133 lpi or higher, the separator implements a quality factor of two. Since offset newspaper production often uses a screen ruling of 85-100 lpi, a quality factor of 1.5 is utilized. These values are based upon visual assessment studies conducted through the production of various substrates at differing line screen rulings. Reproduction on uncoated, porous substrates such as newsprint have an expanded dot gain. The halftone dot (traditionally rendered as two pixels of information in each direction) will spread out over and into the substrate preventing the rendering of such detail. Implementing a quality factor of 2.0 is overkill for our output resolution, so a suitable formula for determining optimum scanning ration is SR = OR x %Mag x 1.5. Consider this example: if our press is running at a line screen of 100 lpi, and we want to magnify our image by four, our scanning resolution would be:

$$100 \times 4.00 \times 1.5 = 600 \text{ samples per inch.}$$

For photographic operations, we have to consider the physical size of our original. Quite often, 35mm film serves as our original size at 1" x 1.5". Additionally, as the photojournalist, we are not certain as to how our image is going to be presented within the publication. Images may be selected for full color on the front page at a size of 5" x 7" or by column width based upon the design used by the paper. Additionally, images may be edited for use on inside pages, black and white at no more than 3.5" x 4". For our purposes, the above formula is utilized with an emphasis on magnification.

Depending upon your workflow, you may want to capture enough data in scanning for full size reproduction. Consider an example where our original may be used for publication on the front page at a size of 6" x 9", or five times the native size of 1" x 1.5". Based upon line screen rulings under 133 lpi, a quality factor of 1.5 may be implemented. As we are imaging at 100 lpi, a factor of 1.5 is applied. Based upon our requirements, the formula is stated as:

$$100 \times 5 \times 1.5 = 750 \text{ samples per inch.}$$

It should be noted that higher resolutions and magnification of the original's native size will increase file size.

Larger file sizes inherently mean longer scanning, ripping, and imaging times. Collectively, this additional time impedes production in a business already tight on deadlines. Depending on you or your organization's workflow, file size requirements may play a significant role in workflow operations. To get handle on file size limitations, the following formula may serve as a guide in your workflow operations:

$$\text{File size} = \text{Resolution}^2 \times \text{Width} \times \text{Height} \times \text{Bits per sample}/8{,}192.$$

The figure 8,192 is derived from the number of bits in a kilobyte. As an example, if we sampled an 8 bit image at a size of 4" x 5" at 600 spi, according to our formula, we can calculate our file size as:

600^2 x 4 x 5 x 8/8192 = 7031 K or just about 7 megabytes.

As is often the case in newspaper production, images may be resized in page layout programs. If a decision is made to increase image size by a factor of two, half of the captured resolution will be lost.

100 percent: 72 spi

200 percent: 36 spi

Figure 3-2
Resolution & Resizing

50 percent: 144 spi

As an example, if a 4" x 5" image is scanned to 300 ppi for a reproduction at 100% and the output size of the image is increased to 8" x 10", the resulting image has an effective resolution of 150 ppi. In contrast, if a decision has been made to decrease the size of the rendering to 50% or 2" x 2.5", the resulting image will have a resolution of 600 ppi. See figure 3-2.

Resampling is a digital application that compensates for the resizing of captured image files. Resampling is a powerful tool, but, if overused, it may yield unwanted results. The process used to digitally compensate for increasing the output size is referred to as interpolation. Interpolation is performed through the addition of samples that have been created based upon averaging the tonal values of surrounding samples. This process offers the ability to increase the overall reproduction size, however, if overused, image quality will suffer. Interpolation may assist the separator, but it can not fill in detail that was never there.

Testing and experience provides the ability to determine justifiable amounts of interpolation. Current reproductions reveal an appropriate amount of interpolation may be applied that does not exceed a level of about 250%. Downsampling is utilized for decreasing the size of the image. This technique implements the same algorithm used for the interpolation of data. This techniques does not attempt to incorporate data that was never captured. Therefore, in some cases, downsampling works slightly better than the addition of data, as samples unnecessary for

Original Image

Figure 3-3
Resampling

Upsampling

Downsampling

reproduction are replaced with intermediate values. See figure 3-3.

Dots per inch (dpi) refer to the resolution of the dot on output devices such as proofers, imagesetters, and platesetters. Once an image has been prepared for production, data from pixel information is analyzed for the creation of halftone dots. This process is known as digital halftoning. In this process, the selected line screen ruling or lines per inch (lpi) is superimposed over the output resolution. In our workflow, the output may be a sheet of film from an imagesetter or the media from a platesetter. Superimposing the line screen ruling over the output resolution establishes a grid pattern consisting of a series of uniform halftone cells. Quadrants within individual halftone cells represent the smallest dot, or pixel the output device may render. See figure 3-4.

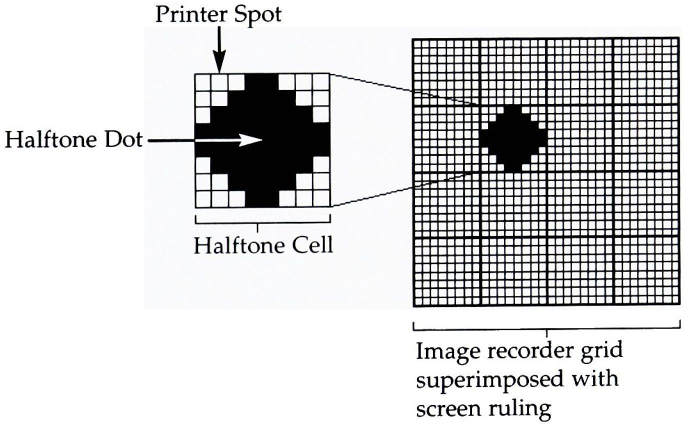


Figure 3-4
Digital Halftoning (illustration by David Meylan, Swiss Federal Institute of Technology)

The number of quadrants, or pixels within a halftone cell may be derived from the following formula:

$$(\text{output resolution}/\text{lpi})^2$$

As an example, printing at 100 lpi on a 1060 dpi imagesetter creates a halftone cell consisting of 112.36

possible dots. Fractions are not possible in digital halftoning, so the number is rounded down to 112 total dots within one halftone cell. Tonal values encompassed within the data from pixel information are then rendered onto output media imaging the appropriate number of dots within a halftone cell. As you may have noticed, the formula stated above for the number of imaged printer spots is the same equation used for determining the number of gray levels in an image. Through this formula, you may visualize how the varying number of printer spots imaged in a halftone dot correlates to the number of gray levels within an image. The greater number of halftone dots with a high amount of printer pixels offers a greater number of gray levels. Dots per inch is also used to describe non-halftone printers such as laser printers, and is also commonly misused in place of ppi and spi.

During press production, resolution may be referred to as lines per inch (lpi) or as the screen ruling (the arrangement of the four-color halftone dot). As seen with the formula for scanning resolution, samples per inch, pixels per inch and dots per inch are all based on the characteristics of color reproduction on press.

Color Setup

With an understanding of the concepts inherent to scanning, we may begin to address aspects of color setup procedures within the color imaging software. The following chapters will use Adobe Photoshop 6.0, acknowledged as the standard for imaging software. As discussed in the introduction, color management systems may be used in your workflow. The following steps take into consideration both color management and print production characteristics.

Opening an image in Photoshop 6.0 requires the application of specific color settings to ensure quality separations. These specifications include appropriate RGB and CMYK color settings, production settings, and color management profiles.

Procedures

Photoshop 6.0 offers a color setup window under the menu: Edit/Color Settings. This window contains the following information: RGB and CMYK color working spaces, gamma, dot gain, and color management policies. Ensuring quality color reproduction requires an understanding and consistent implementation of appropriate color and image reproduction settings.

Achieving specific values for optimum color settings demands effective communication with the newspaper production department. Data captured during press testing provides the appropriate values for the Color Settings options. A professional working relationship between prepress and production is critical for the exchange of skills used within each department for optimum color reproduction on press.

Color Settings Presets:

Photoshop 6.0 offers color preset options that may be suitable for your organizational workflow. In most professional color reproduction procedures, a custom setting option is created to match the internal workflow of the organization. Additional settings for your internal workflow may be held on your local hard drive and applied through the load button at the right of the color setting window. See figure 3-5.

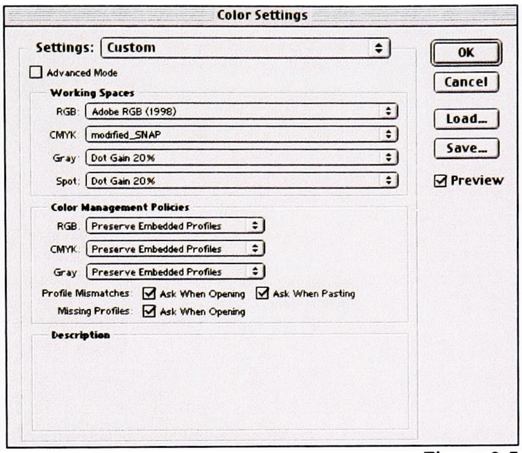
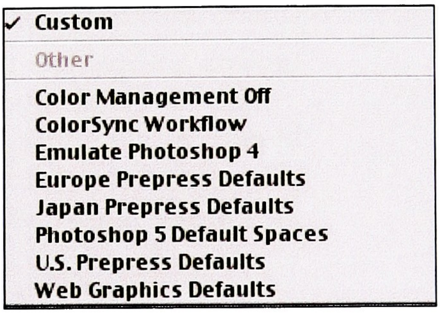


Figure 3-5
Color Settings

Additional Color Settings Presets include (see figure 3-6):

- Color Management Off
- ColorSync Workflow
- Emulate Photoshop 4
- European Prepress Defaults
- Japanese Prepress Defaults
- Photoshop 5 Default Spaces
- U.S. Prepress Defaults
- Web Graphics Defaults

Figure 3-6
Additional Color Presets



Color Management Off: Simply stated, refers to the absence of any color management module. Ignoring any embedded files, this option performs under the working space for that color mode.

ColorSync Workflow: Utilized by Mac operators, this option supports the ColorSync 3.0 or later default profiles for files at the RGB and CMYK color spaces.

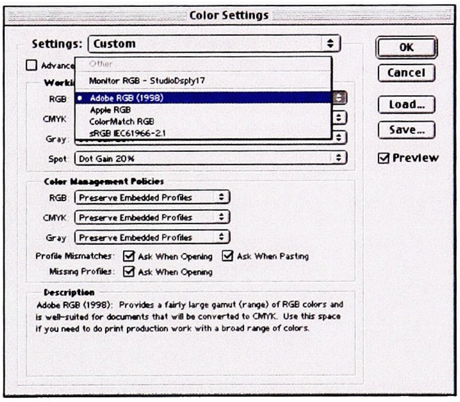
Emulate Photoshop 4: Based upon Photoshop 4, this setting provides different working spaces for RGB and CMYK.

U.S., European and Japanese Prepress Defaults: This option provides an alternative for mismatched files, implementing color management wherever possible within the file.

Photoshop 5 Defaults: This option is available for Photoshop users who are satisfied with the settings from Photoshop 5 or 5.5, and do not wish to convert their settings.

Web Graphics Default: This option sets the working color space to sRGB.

Figure 3-7
RGB Color Settings



RGB WORKING COLOR SPACES:

After defining the Color Settings Presets, the separator indicates the appropriate RGB color working space. By selecting the Advanced Mode button, a custom RGB color space indicating the optimum gamma, white point, and color primary settings may be created. Creating and loading custom RGB profiles in the advanced mode allows for more control in your color working environment. A custom RGB profile provides a more accurate rendering on a calibrated monitor. In addition, RGB color settings have a direct effect on the chosen CMYK setup. If the wrong RGB setup is used, values for quality CMYK output may not be achievable. Different RGB color spaces encompass different RGB color gamuts. Using a custom RGB profile that defines your available RGB gamut will ensure the translation of RGB color values into your CMYK color space. The selection of an alternative RGB color setting may not yeild quality results as compared to your own custom RGB profile.

Extra RGB Color working spaces include: Adobe RGB (1998), Apple RGB, ColorMatch RGB and sRGB See figure 3-7.

Adobe RGB (1998): This option provides the largest RGB color space containing a majority of the CMYK gamut. Some orange, red and green colors are lost. If a custom RGB workspace is not available, Adobe RGB (1998) is a highly recommended default setting.

Apple RGB: This workspace was originated in Photoshop 2.0 and is not highly recommended as default setting.

ColorMatch RGB: This option provides a slightly smaller gamut then Adobe RGB (1998). Some cyan and oranges are left outside of the gamut.

sRGB: sRGB may be suitable for web applications, however it is not a recommended work space for print production, as it has a drastic loss of color in cyan, blues, and greens.

Monitor RGB: Substitutes the monitor profile as the RGB color space.

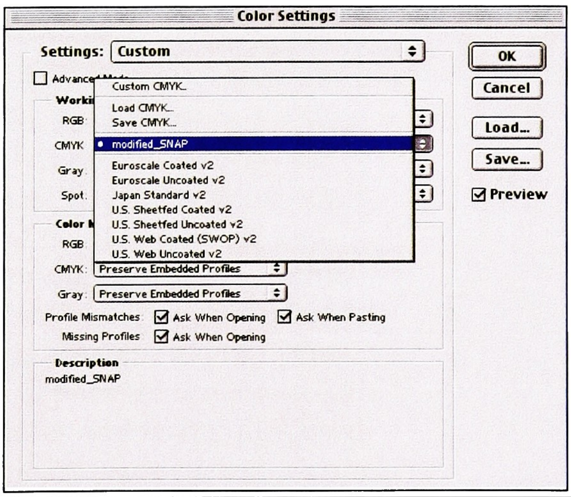
CMYK Color Working Spaces:

Photoshop offers a variety of CMYK color spaces. A production organization often uses a custom CMYK setup to match the characteristics of its press. Custom reproduction settings may be created in-house and loaded into the software or created directly in Photoshop. As with a custom RGB setup, by clicking on the advanced mode button, a custom profile for your CMYK color imaging devices may be added.

If a custom settings is not in place, Photoshop offers the following CMYK color working spaces: SWOP, Euroscale coated and uncoated, Japanese, U.S, sheetfed coated and uncoated and U.S. web uncoated. See figure 3-8. These CMYK settings hold specific attributes for print production that may not match the print characteristics of your pressroom. These default settings have a total ink coverage that ranges from 260% to 350%, with dot gain ranges from a range of 13% to 26%. For professional color reproduction, knowing the characteristics of your press and incorporating the appropriate values into custom CMYK color space assists in achieving optimum print production.

Creating a custom CMYK color setting requires identifying and implementing the appropriate values in your imaging software (see figure 3-9). Based on the ink sets used in production, the creation of an ink lookup table (LUT) is the most efficient way to compensate for hue error (discussed later in the color

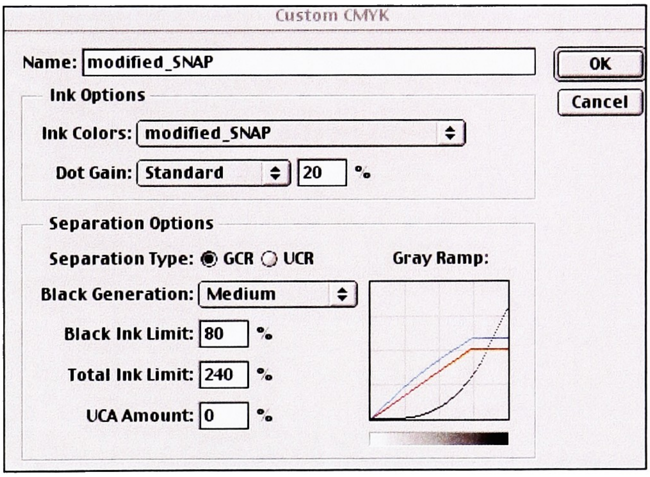
Figure 3-8
CMYK Color Settings



correction chapter) within ink sets. Determined through testing on press, the amount of dot gain incurred on press is indicated in the custom CMYK setup. If the pressroom utilizes under color removal (UCR) or gray component replacement (GCR) settings, their values are applied in the separations options within the custom setup. UCR and GCR are color processing and printing techniques that assist pressroom operations by minimizing problems inherent to web offset printing processes. If one of these techniques is utilized within the pressroom, their values are entered into the custom CMYK setup.

Also part of the CMYK setup is an indication for total ink coverage on press. It is imperative that this value be applied for optimum color reproduction. According to SNAP standards the average total ink coverage for offset newsprint production is 240%.

Figure 3-9
Custom CMYK Settings



It should be noted that the application of default CMYK color working spaces in a production environment will yield color irregularities. As an example, Specifications for Web Offset Production (SWOP) has default settings for newsprint production. A most noticeable color effect of this setting is the unusual rendering of red and orange colors. If you are working in a print production environment, press tests should be conducted to determine the characteristics inherent to your press.

Prepress and production departments need to communicate operating procedures and techniques used for quality color reproduction. Skills used between these departments vary. Without the recognition or identification of these skills between departments, quality color reproduction cannot be achieved. All of the values mentioned in this section are derived from testing done on press. Without an understanding of these values, color reproduction will suffer. Specific values, derived from press testing, can be incorporated into color profiles made specifically for your press conditions. Implementing these values into your color imaging software will greatly assist in achieving optimum quality in color reproduction.

Grayscale Settings:

Grayscale settings are incorporated into Photoshop for assistance in tone reproduction. As with prior RGB and CMYK workspaces, a custom grayscale setting may be created matching your production capabilities. Gamma refers more generally to the appearance of the image on the monitor, not on press. However, a setting of 1.8 provides an appropriate setting for separation techniques.

Spot Space Settings:

Default dot gain percentages, or customized dot gain curves are applied via this window.

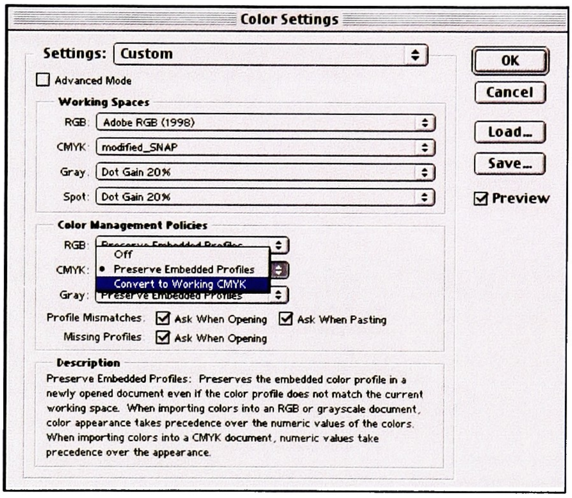
Color Management Policies:

For each color working space three options are available to the separator: Off, preserve embedded profiles, and convert to working CMYK. See figure 3-10.

Off: For images that may have been tagged with color profile information, the "off" selection will fail to recognize the color information of that file. Any adjustments to the file will serve as the existing color working space, as all previous information will be discarded. If an image is acquired that matches the selected working space the color information will be preserved.

Preserve Embedded File: This option preserves an embedded color space. However, if the image is brought into an RGB or Grayscale working space, the changes made are preserved over the tonal values of the tagged image. If the file is brought into a CMYK color space, the tonal values will take precedence over the appearance of the image on the monitor.

Figure 3-10
Color Management Policies



Convert to working space: This option converts an image into the working RGB/CMYK working space created for your internal workflow.

Color Conversion:

Under the Image menu: Image/Mode/CMYK

All color imaging workflows vary. However, the workflow suggested in this guide recommends the conversion to CMYK at this point. Making adjustments in the color separation process effects the tonal values within an image. By converting to CMYK early in the workflow, the separator can see these changes as they effect color reproduction for press operations. These changes can be seen through the values indicated in the Info Palette. Converting to CMYK early in workflow operations prevents the need to review tonal values later in the separation process. Working in RGB will require the separator to review their adjustments to ensure a quality rendering within the CMYK gamut. See figure 3-11.

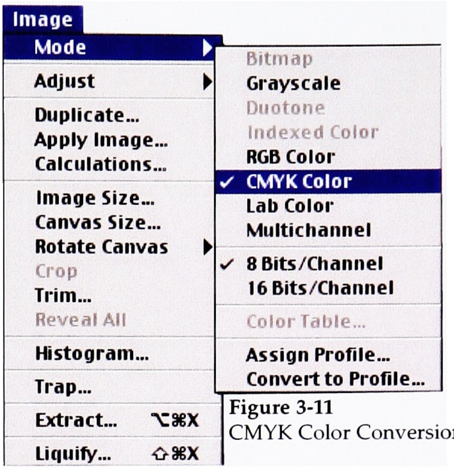


Figure 3-11
CMYK Color Conversion

Under the View menu:
View/Gamut Warning

Photoshop 6.0 has a gamut warning tool available for the color separator. By activating the Gamut Warning, tonal values within an image that exceed the selected CMYK gamut limitations are highlighted. See figure 3-12. By utilizing this feature, the separator obtains a visual representation of colors outside the CMYK gamut. In addition, the Info Palette will display an exclamation point signifying out-of-gamut values. See figure 3-13. Providing the exclamation point gives the separator another tool indicating a deviation in the CMYK gamut.

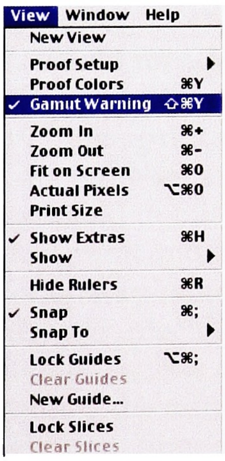


Figure 3-12
Gamut Warning

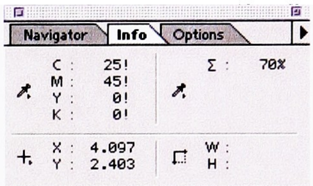
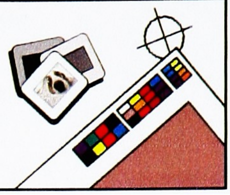


Figure 3-13
Info Palette with Gamut Warning

Highlight Placement

white point



Placement of the highlight or white point is a critical step in creating a quality color reproduction. It is the first point in establishing tone compression. If the placement of the highlight is incorrect, tonal compression will not be achieved and quality will suffer. If not placed correctly, the image may have to be rescanned or replaced with a back-up file.

A highlight is the lightest area of an image that is white, or should have been white if not for the presence of a color cast. There are two types of highlights, *specular* and *diffuse*. A specular highlight does not hold any detail, for example the catch light from a chrome fender on a classic car should not render any detail. A diffuse highlight will hold detail, or the first noticeable printing dot. An example would be the textured pattern from a white shirt. If this area holds the lowest density within an image that is white or should be white, the first printing dot is imaged in this area.

Values for CMYK tonal areas are established through testing performed on press. Often referred to as "fingerprinting" the press, this analysis provides data representative of press reproduction capabilities. Included in this analysis is the measurement of the minimum and maximum percent dot sizes required for quality reproduction of highlight and shadow areas. In placing the highlight, the lowest tonal value (with detail) is assigned to the percent dot area representing the minimum size printing dot on press. In addition, fingerprinting the press provides values required for achieving a neutral gray, or gray balance on press. Gray balance allows the reproduction of neutral grays that visually match the neutrals of the original. According to SNAP standards, neutral values for CMYK highlight dots are 5c, 3m, 3y and 0k at 100 lpi for offset production. By implementing these values in appropriate highlight areas, we ensure neutrality in our images, and assist production operators in maintaining gray balance throughout production.

Selecting an appropriate highlight requires information regarding characteristics of original copy. A properly exposed 35mm negative reversal or transparency may have a highlight of .15 to .45. A photographic print may have a highlight density of .05. Knowing the "normal" or "average" densities of film and reflection copy provides an aim point for highlight placement during scanning or color image processing applications.

Digital cameras do not have the same density characteristics of film or reflection copy. Tonal values are rendered through a CCD array and converted into pixels containing tonal information. For placement of the white point in a digital file, the separator must evaluate the image for the lowest tonal values based upon CMYK or RGB values. Once these values are located, the separator defines the highlight area and applies the necessary tonal values for neutrality if appropriate.

If our highlight is diffuse, detail is present. The first noticeable printing dot is assigned to this area. In comparison, a specular highlight has no detail. Retaining a specular highlight requires the first noticeable printing dot not to be placed within that specific area, but located in an area representing the lowest density area of an image that holds detail.

As an illustration, assume the diffuse highlight of a properly exposed image was .30. If the highlight were to be placed at .40, the overall appearance of the image would be washed or blown out. In this case, the minimum percent printing dot was placed at an inappropriate tonal value. Tonal values that were more conducive to highlight placement were passed over, preventing the imaging of detail. Areas that held detail were never imaged. Therefore, the resulting image appears weak. See figure 4-1 – 4-3.

Figure 4-1
Minimum percent printing dot is placed at a value of .09. This value was too high.

Assuming the opposite, if the highlight were to be placed at .15, the overall reproduction would appear dark and muddy. In this scenario, the minimum percent printing dot was assigned to a tonal area that was not representative of the appropriate highlight area. Printing began too early, and the image progressively became darker as proceeding percent dot areas (including any specular highlight) were printed.

If an image is either under or overexposed, the highlight may be placed for a more suitable reproduction. However, a poor exposure will result in a poor reproduction. Color processing systems can not render data that was never captured. If the exposure is poor but must be used for production, determine the appropriate highlight placement based upon minimum tonal values and adjust tonal gradation through the placement of the midtone.

Figure 4-2
Minimum percent printing dot is placed at a value of .01. This value was too low.

As the human eye is most susceptible to change in color within lighter hues, colorcasts are most prevalent in the highlight area. If a color cast is present in the highlight area, the cast will exist throughout the image. If it is desirable to remove the cast, the neutral values (gray balance) established for tonal reproduction are assigned to the highlight area. Applying these values assists in removing the colorcast, and establishes a neutral density within the highlight area.

If a colorcast is aesthetically desirable for an image, neutral values are not assigned. The colorcast is maintained based upon RGB/CMYK values for the desired color, and appropriate adjustments to the tonal range.

If the image is a quality exposure and lacks a highlight area, a step wedge or gray scale may be added to assist in the creation of the separation. The use of a step wedge will also assist in maintaining gray balance throughout the image. A density on the scale may be selected to reflect the aim point for reproduction. Quite often a step wedge or gray scale may not be feasible in your production workflow. An additional option may be to select a white border that may surround the image.

Figure 4-3
Appropriate highlight placement. For this image, the highlight was placed at .07.

If the original is in a digital format, the separator again bases their selection on the tonal values noted within the information palette of the color imaging software.

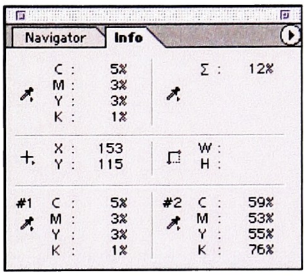
As a final option, the separator may select the minimum tonal values within the image and establish quality tonal reproduction through midtone gradation.

Procedures for Highlight Placement

With an understanding of the concepts inherent to highlight placement, lets take a look at the procedures used to create a quality color separation.

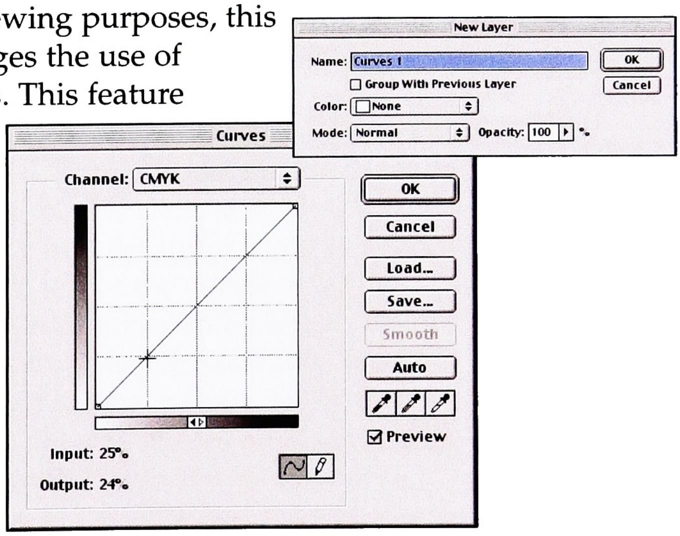
Under the Window menu:
Window/Show Info

Make sure your Info palette is open and set for viewing CMYK percent dot values, and total ink density. This may be done by clicking on the arrow in the top right corner of the Info Palette. Clicking on this arrow allows the separator to select Info Palette options. RGB tonal values may also be viewed in this window. This palette provides a guide in assigning the right values to your image.

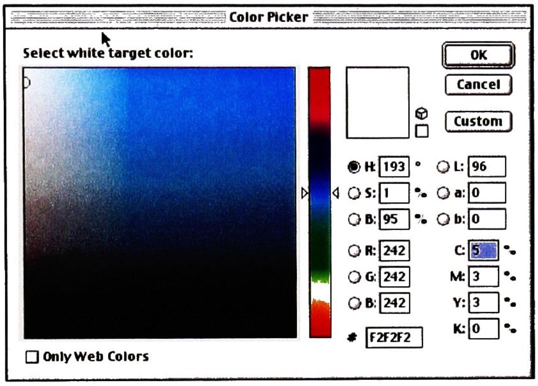


Under the Layer menu:
Layers/New/Adjustment Layer/Curves

For editing and viewing purposes, this workflow encourages the use of Adjustment Layers. This feature allows the separator to edit previous actions with the ability to view changes through activating defined Adjustment Layers.



By clicking on the far-right eyedropper, the Color Picker window opens up and indicates the RGB and CMYK values for the highlight area. Once percent dot size values are defined; they should be incorporated into the Photoshop CMYK setup. Note, if your color picker does not look like the one pictured here, check your preferences. These images have been selected from the Photoshop 6 user interface

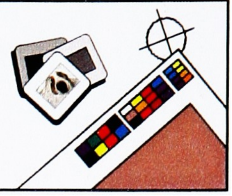


If you are still working in the RGB color space, Photoshop indicates the equivalent values in the CMYK setup based upon your separation setup. According to SNAP, the minimum dot sizes should be 5%c, 2%m, 2%y. After you have selected the desired highlight values for neutrality you may return to your image and place them in the appropriate area.

Further adjustments to tonal and percent dot values may be accomplished by manipulating the curve at respective RGB/CMYK channels, as well as incorporating values directly into the input/output windows located at the bottom left of the curves window.
If you wish to retain a colorcast in an image, do not apply the percent dot values for neutrality. Based upon your RGB/CMYK tonal values, apply the appropriate percent dot size values representing the desired color, or slide the endpoint on the curve.

Shadow Placement

dark point



Placement of the shadow or dark point establishes tonal compression within the color separation. Tone compression permits the rendering of tonal densities that visually match those of the original. This technique is performed through the compression of a larger tonal range into a range reproducible on press.

Figure 5-1
An example of appropriate shadow placement. For this image the Maximum percent printing dot was placed at 1.6.

As stated earlier, the maximum printable density on newsprint is approximately 1.2; therefore the range of tones acquired through image capture must be condensed into this range. As an example, the maximum shadow density from a transparency may be 3.00, while the maximum density of reflective copy from the same image is about 1.9. For the digital photographer, placement of shadow area requires an examination of the darkest tonal values (based upon

RGB/CMYK settings) of an image. A determination of these values defines an area suitable for placement of the maximum percent dot. Originals from reflection, film and digital files possess differing tonal ranges. Understanding the "normal" or "average" tonal range available from these varying sources assists in the selection of shadow areas.

Figure 5-2
The maximum percent printing dot is placed at .75. This value is too low.

As with the setting of the highlight, shadow placement is critical. If the shadow is placed at a tonal value lower then the maximum percent printing dot allowed on press, the resulting image will reproduce dark. In this example, areas that may have held detail in darker areas go solid. By comparison, if the maximum percent printing dot is placed at too high a tonal value, the image will reproduce weak. See figures 5-1 – 5-3.

As mentioned in the previous chapter, fingerprinting the press determines the appropriate values for defining characteristics of tone reproduction, gray balance, and neutral density ranges. As data from these tests is analyzed, percent dot size values are calculated for shadow areas.

Press testing indicates the total amount of ink coverage permitted on press. According to SNAP standards, the total amount of ink coverage allowed on press is approximately 240%. Characteristics of production do vary; some presses may run at a total ink coverage of 260%. SNAP indicates that achieving gray balance within shadow areas is accomplished by assigned neutral values of 60%c, 50%m, 50%y, and 80%k. These values are based upon offset production at 100 lines per inch at a total ink coverage of 240%.

Figure 5-3
Maximum percent printing dot is placed at 2.05. This value is too high.

As with the highlight, defining shadow areas requires an evaluation of the original copy. Considerations include type of original, quality exposure, lighting conditions, subject matter and colorcasts.

If an evaluation of the original reveals the absence of a shadow area, tonal reproduction may be achieved through the placement of midtone density. As we will see in the following chapter, midtone adjustment allows the rendering of tones that accurately represent tones of the original. Once the tonal range has been identified the lack of shadow area will fill in with the appropriate tones. Furthermore, if the exposure lacks in quality (under or over exposed), options may include selecting a suitable shadow area and rendering tonal values through midtone placement.

Appropriate lighting techniques used during image capture ensure quality renderings of tonal areas. The use of main (or front) and fill lighting assists the photojournalist in acquiring a balanced range of tonal areas. Quality lighting provides more detail to an image, particularly to shadow areas. As opposed to backlighting or the use of available light, a main light source fills in shadow areas capturing detail.

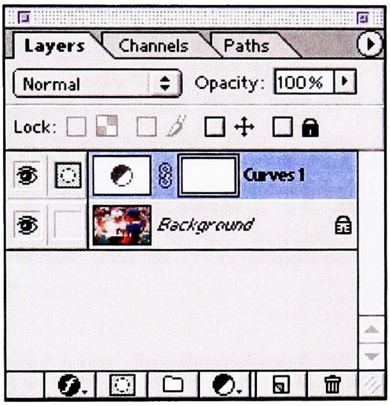
The subject matter of an image requires attention during the evaluation process. An image may be unsuitable for reproduction, yet is essential for publication. In this case, the separator wants to ensure an optimum reproduction of the pertinent subject within the image. Let's consider an example that lacks in exposure quality, holds a drastic colorcast, and suffers from a poor sampling resolution. It may be impossible to compensate for all of the image flaws; however, we can adjust the image for a more useful reproduction. Adjusting for one characteristic may alter another. For instance, applying detail enhancement may amplify poor sampling resolution, or removing a magenta colorcast removes the warm skin tone of our subject. In this scenario, utilizing Photoshop 6.0 tools, it may be wise to implement a mask over the key subject. By doing so, you may build alterations only to the masked area generating a more suitable reproduction.

The last characteristic of original copy to be evaluated is the existence of colorcasts. Compensating for colorcasts involves the same procedures as those listed in the highlight placement chapter. Once the shadow location has been defined, assigning the neutral values defined through press testing assists in removing the cast. If the colorcast is desired, select the shadow applying the appropriate RGB/CMYK values based upon the values of the colorcast.

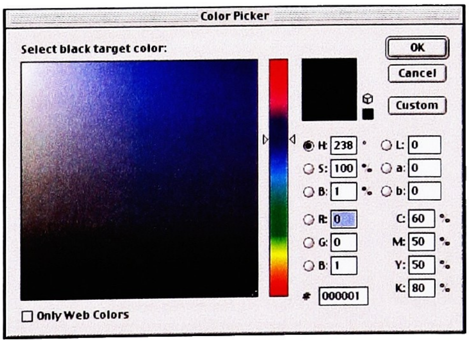
Procedures for Shadow Placement

With an understanding of shadow placement and the concept of tone compression lets take a look at the procedures for creating the separation.

Making sure the Layers palette is open, reactivate the layer for curves.



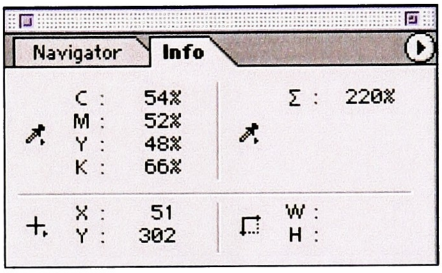
Clicking on the far-left eyedropper within the Curves window, the Color Picker window opens up and indicates RGB and CMYK values for the shadow area. Once press testing has defined percent dot size values for neutrality, these values should be incorporated into the Photoshop CMYK setup. If you are still working in the RGB color space, Photoshop will indicate the equivalent values in the CMYK setup.



According to SNAP standards for offset lithography at a screen ruling of 100 lpi, the maximum dot size values for a neutral shadow area: 60%c, 50%m, 50%y, 80%k for a total ink coverage of 240%.

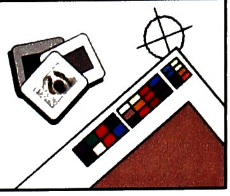
After you have determined the shadow values you may return to the image and assign them to the appropriate area.

Make sure your info palette is open and set for viewing CMYK values, and total ink density. This palette provides a guide in assigning the right values to your image. RGB values may also be viewed in this window.



Midtone Adjustment

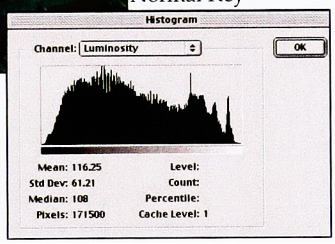
contrast



Midtone adjustment serves two purposes in the color separation process. The placement of the midtone establishes tonal reproduction (visual contrast) and compensates for dot gain in the production process. Midtone values are the range of tones encompassing the center of a full tonal range. An example of a midtone would be an 18% gray card used in photographic operations.

normal-key

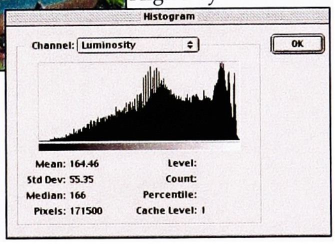
Figure 6-1
Normal Key



Appropriate midtone adjustment is based upon the keyness of an original. Keyness refers to the tonal gradation and location of tonal values within an image. See figure 6-1. If the copy is high in keyness, the tones of the image are predominantly in the highlight to midtone region of the copy. For example, a polar bear on a glacier in the Antarctic would represent a high-key image. In a low-key image, the majority of tones will lie in the midtone to shadow region. A low-key image may be one of a black cat on a dark carpet. Normal or average key images display a smooth transition of tones throughout an image. A normal key image would hold an even tonal range from the highlight to the shadow. An example would be a quality exposed image of a fruit basket ranging from the tones of a dark concord grape to the white inside of a sliced apple. Color separation software and digital cameras often provide a histogram to map the location of tonal values within an image. Viewing the histogram provides the separator with an aimpoint for midtone gradation.

high-key

Figure 6-1
High Key



The objective of the color separator is to adjust for optimum tonal reproduction and visual contrast. As the human eye is most perceptive to tonal changes in lighter areas, the tones within the highlight to midtone area are critical for professional tone reproduction. Through appropriate placement of the midtone values, the separator provides the reproduction with the tonal range required for matching the colors of the original. In addition, visual contrast for the printed image is defined through midtone gradation.

Determining midtone gradation requires the separator to evaluate the keyness of the original. If the original copy is high in keyness, the separator shortens or compresses the highlight to midtone area. In doing so, the tonal range will be compressed, increasing the visual contrast of the printed image. If the

low-key

Figure 6-1
low Key

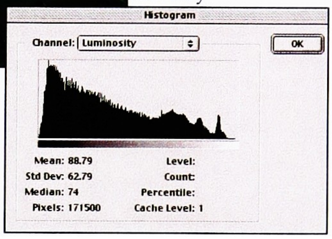


image is low in keyness, the separator extends the highlight to midtone area. This will draw out the tonal range creating a more subtle distinction between tones, therefore adjusting the visual contrast of the printed image.

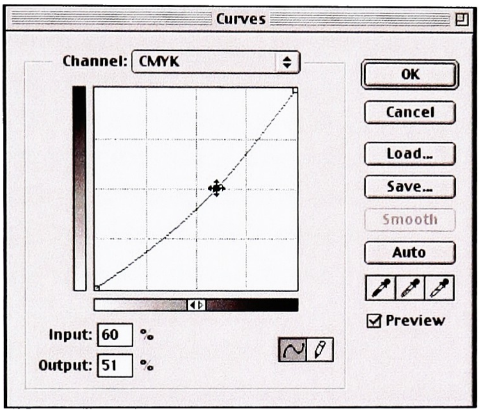
The second function of midtone adjustment is to compensate for dot gain. The existence of dot gain is due to the increase in size of the halftone dot during the printing process. Expansion in size is due to the platemaking process and the impression of the blanket cylinder onto a porous substrate. Fingerprinting the press measures the amount of dot gain at varying percent dot areas. Percent dot areas at the midtone areas usually reveal the most noticeable effects of dot gain as dots begin to connect and overlap. The resulting area plug-up preventing image detail. Depending upon the printing system, press testing indicates that dot gain may range from 15-30%. Compensating for dot gain requires the percent dot areas for midtone values to be adjusted on press for quality image reproduction. Values for dot gain derived from testing should be entered into the CMYK color setup. Depending on the workflow within your organization, adjustments for dot gain may also be made at the RIP during image processing.

To illustrate the concepts of tone reproduction and visual contrast, let's consider an image of a bride and groom dressed in white and black. Rendering this image, capturing detail from the white lace of the wedding gown and the black fabric of the tuxedo provides a challenge in defining the appropriate visual contrast. There are many tools available in Photoshop to tackle this issue. Levels and curves are among the best. Levels provide the separator with a histogram mapping the tonal values of our image. In adjusting the midtone, we can see the redistribution of tonal values within the histogram. Performing this action establishes visual contrast in the reproduction.

Reactivating the Adjustment Layer for curves offers the ability to manipulate the reproduction curve. Adjusting the curves should require the relocation of no more then two points along the curve. As with levels, adjusting the curve allows for the rendering of detail at both ends of the tonal range, and provides visual contrast in a reproduction.

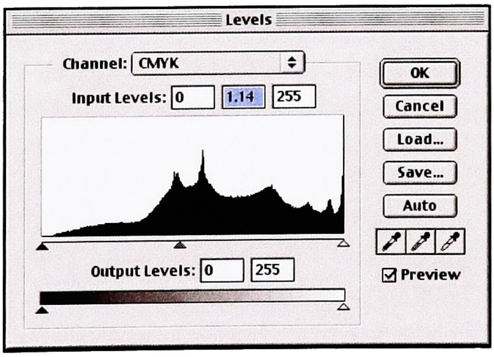
Procedures for Midtone Adjustment

In the layer palette, re-open the Adjustment Layer for curves. Selecting the 50% area of the reproduction curve allows you to adjust the midtone. Based upon the keyness of the original image, you may either increase or decrease the tonal range of the image.



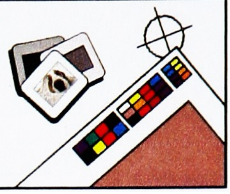
Deselecting the Adjustment Layer provides the opportunity to view the alterations you made to the original image.

Incorporating levels instead of curves makes use of an alternative workflow. As with highlight and shadow placement, there is an adjustment for midtone and contrast within this application.



Color Correction

CMYK RGB



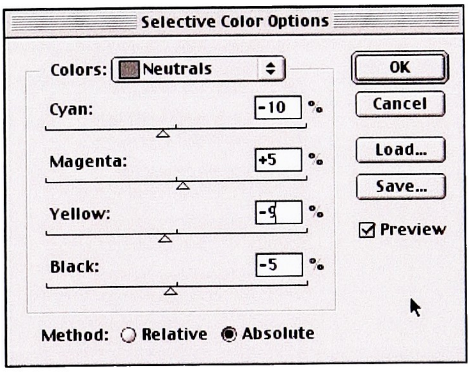
For the colors of a reproduction to accurately match the colors of an original, the separator must apply color correction techniques. The presence of hue error within an ink set necessitates color correction. Hue error refers to the existence of wanted and unwanted colors within specific hues. Theoretically, four-color process printing is based on the assumption of perfect process hues. However, a percentage of colors exist in ink(s) that are not utilized in the make-up of a desired hue. For example, cyan ink will inherently contain small levels of magenta and yellow. To compensate for the problem of hue error, testing must be conducted within the pressroom to measure the amount of unwanted colors within ink sets. Values derived from these tests are then implemented into an ink color look-up table (LUT) within the color imaging software. To illustrate the concept of wanted and unwanted colors, let's consider the reproduction of a green palm from a coconut tree. Overprinting the inks cyan and yellow produce a hue representative of a green palm. Cyan and yellow are considered the wanted color. A portion of magenta ink found in the cyan and yellow inks represent the unwanted color. However, the unwanted color does serve a purpose in the rendering of a desired hue. From the example of the green palm, an appropriate amount of magenta in the green provides form and detail. The addition of the magenta ink is also considered as the graying component. Gray component refers to the addition of the third ink or tertiary color. The presence of this color will gradually enhance the detail of the object. If too much of the tertiary color is added, the hue will become too dark, producing a muddy color.

Color correction techniques are further required due to varying methods of image capture. Each film type is manufactured with specific color dyes. In comparison to color transparency films, color negative films have a broader dynamic range with the ability to reproduce captured densities into a smaller density range. However, due to the manufacturing of color negative films, a colorcast is often rendered in scanning operations. Tools within Photoshop offer the separator the ability to perform global color changes, removing colorcasts found in scans from color negative films. A recommended workflow technique involves color correction using the Levels tool. Working in the RGB color space, a separator views the respective RGB channels and bring the endpoints of the histogram to the first noticeable spike or tonal value. Compressing the RGB tonal range and applying color correction techniques outlined in this chapter assist in creating a quality color separation.

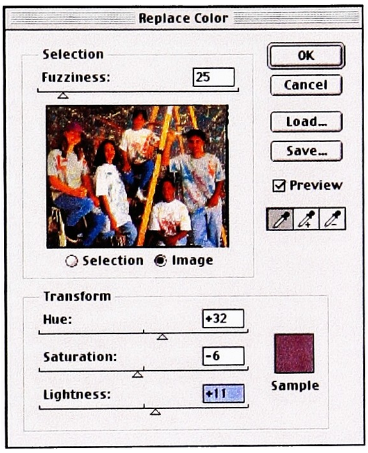
Digital photography often renders colorcasts throughout an image. A CCD array used in digital photography interprets color differently then film. Based upon production tests and profiles generated from various digital and film mediums, ink color tables are developed and implemented into the color imaging software. These tables allow the separator to account for the hue error of inks and variances in image capture techniques.

The separator must acknowledge two concepts inherent to the correction process. First, there must be a categorization of wanted versus unwanted colors. Secondly, the degree of color correction required must be determined. Viewing the colors of the image, a decision must be made as to what hues are necessary in the make up of the desired tone. Once the wanted and unwanted colors have been determined, the separator must consider the degree of change required within the image. Incorporating a color lookup table (LUT) into your color imaging software is the easiest way to compensate of hue error. As stated earlier, a color lookup table is derived through testing done in the pressroom for the determination of unwanted ink amounts within ink supplies. These numbers can be factored into your workflow assisting quality color reproduction.

To achieve quality color or gray balance, the separator may then implement any one of three different correction techniques: global, selective and fine field adjustments. If the separator wishes to change the color of an existing hue throughout the image, a global change should be applied. Typically, a global change is used to account for hue error within an ink set. A global change to a specific hue affects all colors consisting of that hue. For example, if there is an increase to the cyan channel, cyan, blue, and green levels will increase. As cyan is wanted in the makeup of these colors, a global change to cyan will also adjust the blues and greens of the image. It is important to note that cyan will also be altered as a tertiary or unwanted color. Under a global change the cyan ink would also be slightly altered while serving as the graying component, effecting gray balance.



A selective change to color allows the separator to make adjustments to specific values within CMYK and RGB colors. If a hue is made up of specific values creating a distinct color, a selective change will make adjustments only to that particular hue. To illustrate selective color correction, consider an image of the American flag flying against a cyan sky. When we think of the blue in the American flag, we visualize a specific hue, or a memory color. A memory color is a hue that is derived through expectations we have based upon memory. When preparing this image for reproduction, the blue of the flag may appear incorrect. Using the selective color option provides the separator with the ability to make changes to the blue of the flag without effecting the blue of the cyan sky.



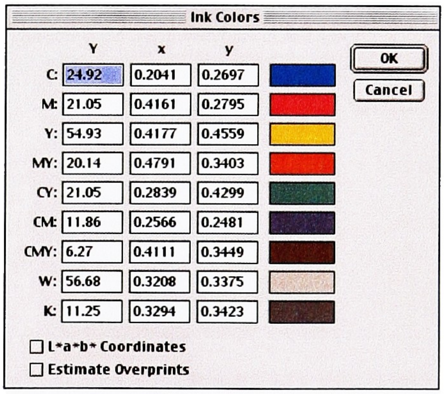
A third alternative is a fine field adjustment. Alterations in the fine field mode act as an extreme version of selective color changes. Fine field corrections permit the separator to manipulate very specific colors within an image by incorporating threshold and level adjustments. If the separator wanted to change the red color of one petal on a fully blossomed rose, a fine field adjustment would produce that change. Note, that all three of these techniques may be used in conjunction with masking techniques utilized in Photoshop. Masking is used to isolate an area within the image and perform adjustments rather then selecting a specific color.

Procedures for Color Correction

Lets take a look at some of the options available to you when applying color correction techniques. The following image will be used to illustrate global, selective and fine field adjustments available to you.

No Color Correction

Before initiating color changes, make sure the correct color lookup table (LUT) has been selected. The best correction for hue error is implementing the color LUT that represents the ink set employed on press. The ink colors chosen should reflect the characteristics of that ink set on press. Within the CMYK setup, you will also be given the opportunity to apply the total amount of dot gain, UCR/GCR settings, and total ink limits. These values are representative of press conditions, and will assist you in creating a quality color separation.

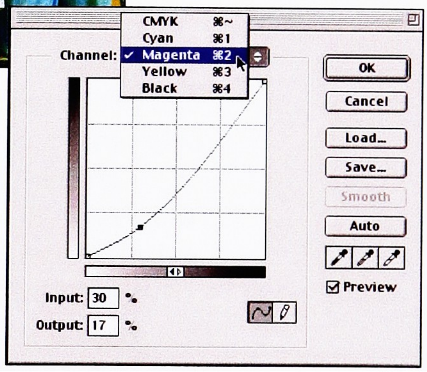


Global Color Correction

If a global correction is desired, you have a few options available to you. First, revisit your adjustment layer for curves. The curves window will allow you to view the respective CMYK/RGB channels. Clicking on the reproduction curve and adjusting the output of an individual channel changes a hue. In addition, more specific values may be assigned to the input and output windows in the bottom left corner of the curves window. It should be noted, that color balance established through the application of neutral values during tonal compression serves as a form of global color correction.

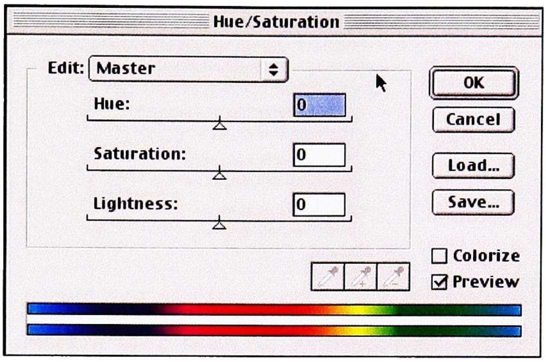
Global Color Correction

In our example, a global change was made via the Curves Layer. Adjusting the respective yellow and magenta curve allows the separator to remove an unwanted colorcast throughout the image.



Under the Layers menu:
Layer/New/Adjustment Layer/Hue-Saturation

By creating a new adjustment layer for Hue/Saturation adjustments, global changes may be applied. The Hue/Saturation window provides the opportunity to make global changes. As the separator, you must be aware of the drastic changes that may occur within this Adjustment Layer. Although this tool is very powerful, the curves adjustment may provide more adequate control of the image.

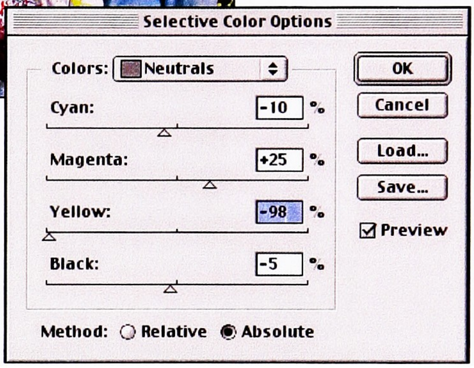


Selective Color Correction

Under the Layers menu:
Layers/New Adjustment Layer/Selective Color

Selective color options provide an excellent tool for more specific color changes. In addition to the respective CMYK/RGB channels, selective color options also include whites, neutrals and blacks. With this tool, you are given the opportunity to make adjustments only to the color chosen. Take note of the relative versus absolute mode at the bottom of the selective color window. It is recommended that the absolute mode be selected. Absolute will determine the quantity of a color you want to change. Relative makes an evaluation and may make adjustments to all channels to achieve the color, making it more difficult to view the changes. The new Adjustment Layer will provide you with the opportunity to view your changes. By clicking on and off of the layer in the layers palette, you will see your color editing adjustments.

Selective Color Correction



In our example, a selective color change was made in the white, neutral, and black channel. Ensuring gray balance, values are adjusted and optimum color reproduction is achieved.

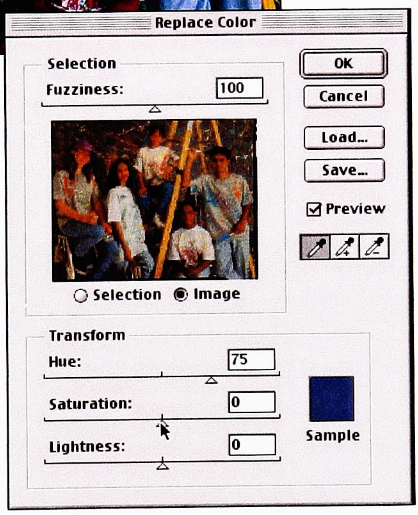
Fine Field Color Correction

Under the Image menu:
Image/Adjust /Replace Color.

If a fine field adjustment is required, you may edit the desired color through the replace color window. Options for fine field adjustments are not available as an Adjustment Layer. Therefore, you must have the background image activated to perform the necessary changes. In order to apply very specific color changes, the eyedropper tool is selected from inside the replace color window. After the hue has been selected, the threshold is defined by assigning the appropriate value in the "fuzziness" channel. The selection window allows you to see what areas will be affected. Once the hue has been defined, you may adjust the color by applying the desired values into the Hue, Saturation, and Lightness channels at the bottom of the replace color window.

Fine Field Color Correction

Take note to the paint brush in the young man's left hand. In the previous illustrations, the paint was a highly saturated green. Using a fine field adjustment, only the color of the brush was changed, no other hues were affected.



Detail Enhancement

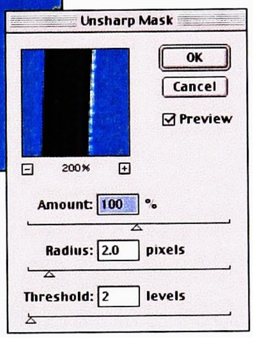
sharpening

Detail enhancement is required in the separation process for two significant reasons. First, the printing process offers variables that affect the rendering of detailed images. Variables include porous substrates and the existence of dot gain on press. Absorbent substrates, such as newsprint, are unable to render fine detail due to the expansion of the halftone dot on press. As compared to a screen ruling of 133 lpi in commercial offset lithography, a screen ruling of 85-100 lpi is used in newspaper production. Compensating for reproduction on porous substrates and dot gain, a screen ruling of 85-100 lpi is too coarse for the reproduction of fine detail.

Figure 8-1
No Unsharp Masking

As an analogy, visualize the difference between two colanders or sieves. One sieve is made up of 133 holes; the second contains 85 holes.
If a bottle of water (ink) were to be poured into each respective sieve, the sieve made up of 133 holes permits a greater amount of liquid to flow through its basin, i.e. a greater receptor of ink or the halftone dot.

Figure 8-1
Appropriate
Unsharp Masking



In comparison the sieve made up of 85 holes permits a flow of liquid through fewer, more widespread openings proving less conducive for the reception of ink or the halftone dot.

Secondly, image sharpness will degrade through generations beyond the original. Dupes made from transparencies and prints imaged from film all have diminished amounts of detail.

The color separation process compensates for loss of detail in the production process by implementing detail enhancement or unsharp masking (USM) techniques. The process of unsharp masking is based upon traditional photomechanical processes where a slightly out-of-focus duplicate negative (mask) was combined with the original negative in the enlarger. The resulting imaged revealed a halo effect around image areas—a dark halo around dark edges, and a light halo around lighter edges. The presence of the halos provided the appearance of visual contrast or enhanced detail to the viewer. Color imaging software incorporates detail enhancement using theories of the photomechanical process. Based upon the tonal values of a specified area, unsharp masking adjusts pixel values for the creation of a light or dark line surrounding that particular area. Detail enhancement cannot be used to render detail that was never captured in the original. If the copy is out of focus, unsharp masking will only exaggerate the fuzziness of the image.

When using the unsharp masking tool, the amount of fine detail in an image should be considered. Visualize the finess of a small child's hair. A quality reproduction would reveal a soft, natural appearance of the child's hair. Applying too much unsharp masking could result in a coarse unusual reproduction of the hair.

The color separator must consider the source of the image before applying detail enhancement. Both the CCD scanner and digital camera add noise to the digitized image. The separator must account for these artifacts before applying unsharp masking. If these artifacts are not removed, unsharp masking will also enhance their presence in production.

Additionally, the resolution of an image and the enlargement from the native size of the original creates a loss in detail. Lower resolutions as well as greater enlargement sizes require higher amounts of USM. Unfortunately there are no set standards for detail enhancement applications. Testing is done on press to determine adequate amounts of USM.

Manipulating the pixels of an image for additional sharpness is accomplished through levels of Radius, Amount, and Threshold. See figures 8-1 – 8-3. Applying the appropriate Radius defines the thickness of the line, and is commonly considered the first step in applying unsharp masking. Determining the Radius is a critical step in the USM process. As the Radius defines the width of the line, an evaluation of the original should be performed. Considering the aesthetics of the image, a high amount of detail may not require a large radius. Consider the example of the child's hair; the reproduction should depict a soft and smooth rendering. Accentuating the Radius may result in an unrealistic looking reproduction. Referring to our example, if the radius were set too high, the appearance of the child's hair would be rough and jagged. The output device and size of the reproduction should be considered. For newspaper production at a coarse screen ruling of 85 to 100 lpi, a small Radius may be ineffective for enhancing detail. The radius may have to be expanded for newspaper production. However, if the final size of the reproduction is large, the Radius setting may be detrimental to the image. If the width of the line is too large, an unrealistic rendering will again result. For these reasons, applying a suitable Radius is critical for reproduction.

Amount determines the peak height of the USM signal. The height defines the intensity of the white or black line between pixels. The Amount settings may be entered up to 500% producing either an intense white or dark line. A good starting point in determining the correct Amount setting is between 200% and 400%. At this setting, you may work backwards searching for the desired contrast. The Amount

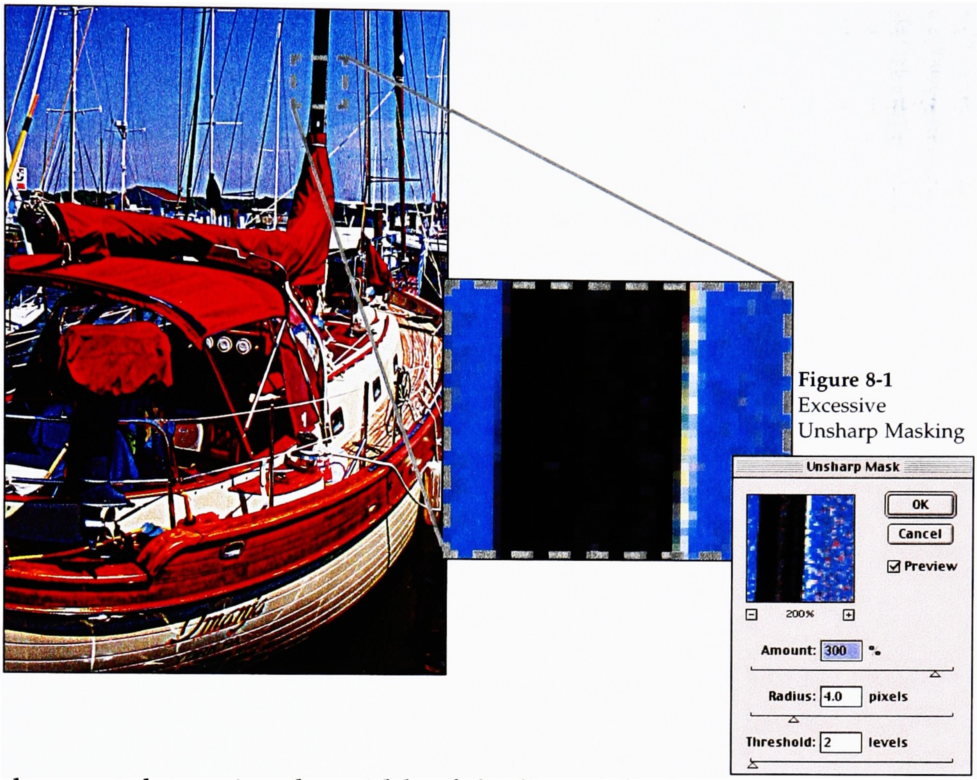


Figure 8-1
Excessive
Unsharp Masking

does not determine the width of the line, only the intensity required for the appearance of contrast.

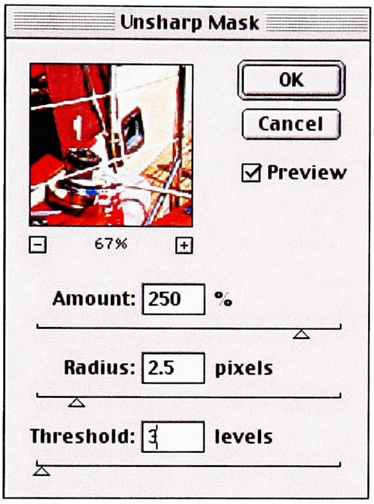
Finally determining what pixels are to be effected is defined through setting the Threshold. This function allows the separator to decide how far apart tonal values (from 0 to 255) must be before unsharp masking begins. If the Threshold is set to four, and two neighboring tonal values are 117 and 119, unsharp masking will not be applied to this area. Threshold proves useful in situations were edge detail may require sharpening, but tonal areas do not.

These three functions are very powerful and must be selected carefully. Overextending their capabilities may lead to increased noise within the reproduction. All images are different, and therefore require varying amounts of unsharp masking.

Procedures for Detail Enhancement

Under the Filter menu:
Filter/Sharpen/Unsharp Mask

Applying detail enhancement techniques will require you to work in the background layer, as no adjustment layer is available for this application. As the separator, you should experiment with unsharp masking and acquire a feel for its ability. For applications in newsprint, threshold and radius amount should be kept low; as the amount should be emphasized.



Epilogue

This guide has been designed and written specifically for the photojournalist creating desktop color separations. The goal of this publication is to assist photographic departments in their attempt to improve the reproduction of their images. The image-maker and print specialist often differ in their specific approach to rendering a quality product. Their goal, however, remains the same: a professionally printed publication.

Photojournalists are often provided a check list on how to prepare an image for production. This is done without a clear understanding of the concepts supporting color reproduction. Problem solving tasks become difficult in the creation of color separations, as image makers may not possess the skills necessary for discovering a solution. The terminology used between the image-maker and print specialist often remains the same, different only in their definitions. This guide clarifies these terms as they relate to the operations performed in color reproduction.

Arranged through individual chapters, this guide has offered a recommended workflow. Within these chapters, the rules and concepts that bind the functionality of each task are defined and discussed. By reading this material, photojournalists may begin to better understand the concepts behind their tasks.

These chapters scratch the surface of the technical aspects that govern quality print production. Acknowledging and understanding these concepts can only assist the photographer in achieving their goal. Reading this information may also provide the incentive to broaden skills and seek further education.

A wide array of sources are being used for the acquisition of images. Wire service, Internet and various file formats are used to transmit images. Each source carries their own characteristics for quality color reproduction. However, the rules and concepts that bind quality renderings remain the same regardless of imaging software, image format or printing process. Knowing these concepts can only help in beginning to solve the color characteristics of various image sources.

Glossary

Bit
Abbreviation for binary unit. The basis unit of measurement in digital information. A binary unit is marked by either zeroes or ones.

Bit Depth
The number of tones recorded from a sample. The larger (or deeper) the bit, the greater amount of color information and intermediate tones captured.

Bitmap
An array of bits that encompasses an electronic page defining the position of every spot or bit.

Calibration
The process of ensuring that all color production devices conform to a series of standards either determined by the manufacturer, user, or organizational specifications. This is done to ensure the quality and consistency of devices used in production.

CCD (Charged-Couple Device)
An electronic element used for the digital capturing of color information in scanners and digital cameras.

CIE L*a*b*
A three dimensional color space often serving as an independent color space for the transition of RGB into CMYK working spaces.

CMYK
Abbreviation for the subtractive, four-color printing process. Cyan, magenta, yellow and black. K (representing key) is used for black.

Color Balance
Also known as gray balance. The printing of C,M,Y values in a proportional amount to achieve neutrality, correct for color casts, and reproduce tonal values that closely match the original.

Color Cast
The presence of an un-wanted color in an original image or reproduction.

Color Management
Color management systems ensure the reproduction of a color image in prepress and production operations. Color management systems are based on the assumption that all color devices are calibrated. Based on this assumption, color management systems define the color space and gamut of eah device through the generation of color profiles. Color management systems will then act as a translator between dependent color devices via an independent color space representative of ideal standards in quality color reproduction.

Color Separation
The photomechanical or electronic process of converting RGB color originals into respective cyan, magenta, yellow and black units.

Color Space
The three dimensional planes within the visual part of the electromagnetic spectrum that make up respective RGB and CMYK working spaces for color processing instruments.

Contrast
An appearance term that describes how tones are rendered from light to dark in an image; a photographic

term that describes how density increases as a function of exposure increase.

Density
The ability of a sample to stop or absorb light; the darkness of an area. The higher the density, the darker the area. The lower the density, the lighter the area.

Dot Gain
A manifestation inherent to the printing process that increases the size of the printing dot in the production process.

Downsampling
Utilizes mathematical algorithms for electronically decreasing the size of an image for quality reproduction.

DPI (Dots Per Inch)
Stated as the resolution of output devices such as imagesetters, platesetters, proofers and laser printers.

Gamut
Within a specific color imaging or production device, gamut refers to the range of different colors that can be defined by these respective devices.

Gray Balance
The combination of proportional amounts of CMYK values for the reproduction of a neutral gray.

GCR (Gray Component Replacement)
GCR permits the replacement of the third or tertiary color in reproduction. The third color is replaced with black in order to reduce the total amount of ink used in production.

Gray Levels
The number of gray values or intermediate tones within one bit.

Halftone
The use of binary information for the reproduction of a continuous tone image through the creation of halftone dots.

Hue Error
The presence of an un-wanted color within the respective colors of a supplied ink set.

Interpolation
The process used to digitally compensate for increasing the output size of an image after scanning or digital capture of the original.

Keyness
Keyness may be defined as the location of the dominant tonal information within an image. If an image is referred to as high-key, the tones of the image fall predominately between the highlight to midtone region. If an image is termed low-key, the location of the tonal values fall within the midtone to shadow area. A normal-key image has an equal distribution of tonal values throughout the image.

LPI (Lines Per Inch)
Abbreviation for lines per inch; refers to the spacing of the halftone image on the printing substrate; the higher the LPI, the greater potential for the halftone to render image detail.

Memory color
A hue that is derived through expectations we have based upon memory, i.e. a red apple and green grass.

Midtone
The tonal range between the highlight and shadow areas of an image.

Neutrality
Equal or proportional values of color without any distinct bias to hue that will render as a neutral gray.

Pixel
Abbreviation for picture element. The smallest unit of measurement that can be adjusted for reproduction.

PPI (Pixels per-Inch)
A measure of resolution for digitized images in color imaging software or digital photography.

Resolution
A measurement of image clarity or sharpness that can be rendered by individual printing or display devices. May be referred to as samples, pixels, spots, dots or lines per inch within particular aspects of the production process.

RGB
Abbreviation for the additive colors generated through the mixture of light. Red , green and blue.

SNAP (Specifications for Newsprint Advertising Production)
A set of published guidelines supported by industry for quality color reproduction in newsprint.

Tone Compression
Reducing the tonal range of an original image into a tonal range reproducible on press.

Tone Reproduction
Manipulation of the tonal range in the reproduction for an optimum color rendering of the original.

USM (Unsharp Masking)
Based upon a photomechanical process, USM provides the appearance of enhanced detail to an image through the application of additional visual contrast inside and around tonal areas.